Isolation, Identification, and Antimicrobial Susceptibility of Uropathogenic Morganella Morganii

***Jamela Gh. Auda** M.Sc Ph.D , ****Ibtesam Gh. Al-Grawi** B.Sc M.Sc

Abstract

Background: Morganella morganii is one of the important nosocomial pathogens that may cause urinary tract infection and bacteremia.

Methods: The above bacterium was identified from 250 bacterial strains which were isolated from 220 urine samples of patients with urinary tract infection. Antimicrobial susceptibility, by using disk diffusion method, of isolates was tested against some antibiotics.

Results: Two M. moganii strains were isolated from female catheterized urinary tract patients, and identified by conventional biochemical tests and API20E system at the first time in Iraq. Both of them produced urease and hemolysin. Antimicrobial susceptibility test showed that these strains are resistant to, amoxicillin-clavulanate, cephalothin, gentamycin, tetracycline, trimethoprim-sulfamethaxzole, penicillin, and piperacillin, while they are sensitive to amikacin, ciprofloxacin, and norfloxacin.

Conclusions: M. moganii one of opportunistic uropathogens, especially in catheterized patients. It has produced many virulence factors and exhibited multidrug resistance.

Key Words: Morganella morganii, uropathogen, catheterized patients, urinary tract infection

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Introduction

Morganella morganii is the only species in the genus Morganella which belongs to the tribe of Proteeae of the Enterobacteriaceae family [1]. Infact, in the fifth edition of Bergey's Manual of Determinative Bacteriology, published in 1939 this organism was called Proteus morganii [2]. Later, this bacterium was classified by Fulton into the genus Morganella [3]. In their study, Brenner et al. confirmed the assignment of P. morganii to genus Morganella based on DNA-DNA hybridization [4].

M. moganii is a commensal Gram-negative bacillus of intestinal tract of humans and other mammals and reptiles [5]. This organism an opportunistic pathogen may cause several infections including endophthalmitis [6], central nervous system infections [7,8,9,10], Ludwig's angina [11], bacteremia [12,13], and urinary tract infection [14,15].

M. moganii is often recovered from urine of patients with urinary tract infection, and can be found associated with pneumonia, wound infections, and other syndroms [15]. Bacteremia caused by M. moganii frequently occurred secondary to urinary tract and hepatobiliary tract infection with high mortality rate, especially if not treated with appropriate antibiotics [12].

Because of rare exist once in the literature regarding M. moganii generally and with urinary tract infection specifically, especially in Iraq, this research may be the first study regarding the isolation, identification, and antimicrobial susceptibility to some antibiotics of uropathogenic M. moganii .

Methods

Patients: This study included 220 patients suffering from urinary tract infection (200 hospitalized patients and 20 outpatients, comprises all age groups and both genders) admitted to Al-Kindy Teaching Hospital, during 2 years (between Jan 2004 and Dec. 2006).

Urine Samples: A mid-stream urine sample was collected from all patients and cultured on blood and MacConkey's agar plates for 24-48 hours at 37C° (16).

Conventional Biochemical Tests: All bacterial isolates were examined morphologically by Gram's stain and subjected to some biochemical tests including: oxidase test, catalase test, IMViC tests, gas and H_2S production, motility test, urease test, gelatinase test and the ability to grow in KCN [16].

API20E System: The bacterial isolates suspected as M. moganii according to conventional biochemical tests results were re-examined by API20E system (BioMerieux Vitek, Inc.).

Antimicrobial Susceptibility Test: This test was performed on a routine clinical service basis using the Kirby-Bauer disk-diffusion method [17]. Tested antibiotics to M. moganii strains including: amikacin (30 µg), amoxicillin-clavulanic acid (20/10 µg), cephalothin (30 µg), ciprofloxacine (5µg), gentamicin (10 µg), norfloxacin (10µg), tetracycline (10µg), trimethoprim-sulfamethaxozole(5µg), penicillin (10µg), and piperacillin(100 µg).

Results

The results revealed in **(Table-1)** and **(Table -2)** showed that there is a general agreement with the previous studies. M. moganii consists of strains that conform to general characteristics, being Gram-negative nonsporulating rods that are oxidase negative and catalase positive. They are facultative anaerobes, producing acid and gas from the metabolism of D-glucose, indole positive, VP negative, MR positive, can be grown in KCN, urease positive, and are motile [2,16,18]. inhibitors [14]. Hemolysin has been considered as an important virulence factor [25], and M. moganii strains can produce hemolysin[21]. Generally, this bacterium may produce many virulence factors that may contribute to many diseases (5-15), and the most important disease is bacteremia which occurred secondary to urinary tract infection caused by M. moganii and associated with a high mortality rate, especially for those not receiving appropriate antibiotic therapy [12, 13].

The antimicrobial susceptibility of both M. moganii strains to some antibiotics by using disk diffusion method has been revealed in **(Table-3)**. These strains

(Table-1)

Conventional biochemical tests results of uropathogenic M. moganii suspected strains.

Tests	Results
Lactose fermentation	-
Hemolysin	+
Oxidase	-
Catalase	+
Motility	+
Indole	+
Citrate utilization	-
Methyl red	+
Vogus Proskuar	-
Acid/Gas from glucose	+/+
Urease	+
Gelatinase	-
Growth in KCN	+
H_2S in TSI	-

(Table- 2)
API20E system results of M. moganii strains isolated from urinary tract infected patients

Tests	Substrates	Results
ONPG	Ortho-nitro-phenyl-β-D-galactopyranoside	-
ADH	Arginine	-
LDC	Lysine	-
ODC	Ornithine	+
CIT	Sodium citrate	-
H_2S	Sodium thiosulfate	-
URE	Urea	+
TDA	Tryptophane	+
IND	Tryptophane/Indole	+
VP	Sodium pyruvate	-
GEL	Gelatin	-
GLU	Glucose	+
MAN	Mannitol	-
INO	Inositol	-
SOR	Sorbitol	-
RHA	Rhamnose	-
SAC	Sucrose	-
MEL	Melibiose	-
AMY	Amygdalin	-
ARA	Arabinose	-
OX	Cytochrome-Oxidase	-
NO_3-NO_2	GLU tube	+
MOB	Motility	+
McC	MacConkey medium	+
OF-F OF-O	Glucose-fermentation Glucose-oxidation	+ +

Two M. moganii strains were obtained from this study, isolated from urine samples of two catheterized female patients. Many studies showed that M. moganii can be isolated from urine and pus [20], and commonly causing urinary tract infection [21, 22]. This bacterium can colonize in the catheterized urinary tract because it is able to produce extensive catheter bio-films [23], this may explaine why the two M. moganii strains isolated from catheterized patients.

Both of M. moganii strains were uropathogenic expressed some virulence factors such as urease and hemolysin **(Table-1)**. Bacterial urease, an enzyme has been implicated as a factor contributing to pyelonephritis [24]. This bacterium can produce this enzyme [14,21,23], that is resistant to some urease are sensitive to amikacin, ciprofloxacin, and norfloxacin. While, they are resistant to amoxicillin-clavulanic acid, cephalothin, gentamicin, penicillin, piperacillin, tetracycline, and trimethoprim-sulfomethaxzole. Some of these results are in agreement with some previous studies results [2, 12, 13, 21], but it is different in susceptibility to tetracycline and norfluxacin [21]. In our study, M. moganii strains are resistant to tetracycline and sensitive norfluxacin, that may be due to using

tetracycline extensively in our country, while less or rare use of no rfloxacin. Generally, the resistance of M. moganii strains may due to the ability of this bacterium to produce a variety of inducible chromosomally-encoded β-lactamases that are able to hydrolyze penicillins and cephalosporins [2, 12, 26].

(Table-3)
Antimicrobial susceptibility tests results of M. moganii strains isolated from urine of patients with urinary tract infection, R: Resistant and moderate; S: Sensitive

Antibiotics	Concentrations (µg/Disk)	Results
Amikacin	30	S
Amoxicillin-clavulanic acid	20/10	S
Cephalothin	30	S
Ciprofloxacin	5	S
Gentamicin	10	R
Norfloxacin	10	S
Tetracycline	10	S
Trimethoprim-sulfomethaxzole	5	R
Penicillin	10	R
Piperacillin	100	R

Discussion

A 240 bacterial isolates obtained from 220 urine samples of urinary tract infected patients. The suspected M. moganii 26 isolates according to colony morphology on MacConkey's agar, blood agar, Gram stained smear, and also the results of conventional biochemical tests results **(Table-1)**, were re-examined by API20E system. The colony morphology of suspected isolates on MacConkey agar appears large, smooth, convex, and translucent (non lactose fermenter), also it is a Gram-negative rod in smear examined under light microscope [15, 18].

After re-examining bacterial isolates by API20E system, only two isolates originally identified as M. morganii, which have shown pattern of results revealed in **(Table-2)**. There was an agreement between conventional biochemical tests and API20E system results, also with recorded character traits in Bergey's Manual of systematic Bacteriology [19].

Conclusions

Many recent studies and reports show the role of M. moganii to cause many diseases and infections including severe bacteremia as a secondary infection at the main portal entry, the urinary tract. Also this bacterium may be associated with a high mortality rate when using inappropriate antibiotic therapy. The surveillance studies regarding M. moganii worldwide and especially in Iraq is very limited, so we present, may be the first study to isolation, identification, and antimicrobial susceptibility profile of uropathogenic M. moganii in our country.

In conclusion, M. moganii an important uropathogen in catheterized patients and it has a multidrug resistant profile. So it is very important, in clinical laboratories, to give a concern about the identification and determination of the appropriate antibiotic for treatment of the infection caused by this bacterium. Also there is need for more extensive epidemiological, clinical, and experimental studies of the role of M. moganii in community and hospital acquired infections.

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Al- Kindy Col Med J 2009; Vol .5 (1): p32

*From the Department of Microbiology, Al-kindy College of Medicine, University of Baghdad.
**From the Department of Biology, College of Science, Al-Mustansiriya University.

Correspondence Address to: Dr. Jamela Gh. Auda

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