



CMPT Clinical Bacteriology Program

Innovation, Education, Quality Assessment, Continual Improvement

Challenge M092-1

August 2009

Midstream urine: $\geq 100 \times 10^6$ ufc/L *Morganella morganii*

HISTORY

This sample was a simulated midstream urine reportedly from a 75 year old woman in a nursing home, febrile and confused.

The sample was sent to category A, B, and C laboratories, which were requested to process and report as per their usual protocol. Participants were expected to process the urine according to their normal protocol, identify *Morganella morganii*, and perform susceptibility testing.

CMPT QA

The sample yielded $>100 \times 10^6$ cfu/L *Morganella morganii*, pure and viable for 9 days

Grading: maximum grade: 32 (4 each for colony count, identification, and susceptibility to 6 antimicrobial agents)

Laboratories were graded on the antibiotics reported therefore the maximum grade for each laboratory may differ.

SURVEY RESULTS

Identification and colony count (Tables 1 and 2)

Reference labs: 15/15 labs reported $\geq 100 \times 10^6$ cfu/L *Morganella morganii* +/- ssp *morganii*. Consensus was achieved by the reference labs thus the sample was considered suitable for grading.

Most of the laboratories (96%) reported a colony count between 50 and $>100 \times 10^6$ cfu/L

and were given a grade of 4. One laboratory reported $>10^5$ cfu/L and another reported >100 cfu/L; these received a grade of 1. One laboratory did not report the colony count and was given a grade of zero.

Overall, 91% of the laboratories (97% of A, 97% of B, and 47% of C) correctly identified the microorganism as *M. morganii* and received a grade of 4. Other responses were assigned grades as shown in Table 2.

Antimicrobial Susceptibility Testing (Table 3)

Reference Labs: all 15 laboratories tested and reported susceptibility to ampicillin, cephalotin/cefazolin, centamicin/tobramycin, trimethoprim-sulfamethoxazole (SXT), fluoroquinolones, and nitrofurantoin. The isolate was found by all reference laboratories to be resistant to ampicillin, cephalothin/cefazolin, and nitrofurantoin, and sensitive to the aminoglycosides, SXT, and fluoroquinolones.

Overall, 99% of the laboratories reported the expected results for the antibiotics tested.

Sixteen category A laboratories added a cautionary comment that *Morganella* may produce inducible beta lactamase.

ISOLATION and COLONY COUNT

The laboratory must quantitate midstream urine culture results to determine the clinical relevance of an isolate. The most commonly used criterion for defining significant bacteriuria is the presence of $>100 \times 10^6$ cfu/L. The media

Grading

Maximum grade: 32 (4 points each for identification, colony count and each of the antibiotics tested).

Reporting other counts than $\times 10^6$ cfu/L was downgraded to one.

The lab that did not report results received a grade of zero.

Reporting coagulase negative Staphylococcus (CNS) was graded zero.

Laboratories received a grade of 4 for each antibiotic susceptibility that was correctly reported.

Laboratories that reported nitrofurantoin intermediate instead of resistance were downgraded to 3.

Table -1: Reported results for M092-1 –Colony count component -

Reported colony count ($\times 10^6$ cfu/L)	Total	%	Grade
$\geq 100, \geq 10, 75, 50-80$	119	96.0	4
>100 cfu/L*	1	0.8	1
$>100,000$ cfu/L	1	0.8	1
no report	1	0.8	0
snp, refer	2	1.6	ungraded
Total	124	100.0	

snp - specimen not normally processed; * laboratory did not report $\times 10^6$

Table-2: Reported results for M092-1 –Identification component -

Results	A	B	C	Total	%	Grade
<i>Morganella morganii</i> +/- ssp <i>morganii</i> , +/- snnp, refer	76	30	7	113	91.1	4
<i>Morganella morganii</i> or <i>P.mirabilis</i> , possible, refer			1	1	0.8	4
CNS		1		1	0.8	0
probable coliform, refer			1	1	0.8	ungraded
growth, refer			6	6	4.8	ungraded
snp, refer	2			2	1.6	ungraded
Total	78	31	15	124	100.0	

chosen for processing urine cultures must be able to support the growth of urinary pathogens and possible contaminants, inhibit *Proteus* spp from swarming, and distinguish lactose and non-lactose fermenters.²

IDENTIFICATION

The genus *Morganella* belongs to the tribe Proteae of the family Enterobacteriaceae. The genus consists of one species, *Morganella morganii*, with two subspecies *morganii* and *sibonii*. Identification of *M morganii* is made by the recovery of small oxidase-negative, catalase and indole-positive gram-negative rods on blood agar or MacConkey agar. *M morganii* ferments glucose and mannose but not lactose.

It is motile, facultatively anaerobic, and it hydrolyzes urease and reduces nitrates. Unlike *Proteus* species, swarming does not occur.^{3 4} Differentiation of the subspecies is based, almost solely, on the fermentation of trehalose. *Morganella morganii* subsp *morganii* is contained in the databases of the major identification systems and the accuracy of identification approaches 100%.

CLINICAL RELEVANCE

Morganella are opportunistic pathogens that are found commonly in soil, water and sewage. These organisms are commonly isolated in the laboratory and may be associated with significant infections of the urinary tract and wounds.

The Committee recommends that all Proficiency Testing samples should be processed as routine samples even when there is a staff shortage or high workload.

Table-3: Reported results for M092-1 –AST component -

Results						Laboratories					
Amp	Cep/Cz	FD	SXT	Cip/Nor	Gen/Tob	A	B	C	total	% Total	Grade(of max)
R	R	R	S	S	S	58	26	4	88	71.0	24/24
R	R	I	S	S	S	2	0		2	1.6	23/24
NR	R	R	S	S	S	3	2		5	4.0	20/20
R	NR	R	S	S	S	2	1		3	2.4	20/20
R	R	R	S	S	NR	3			3	2.4	20/20
R	R	R	S	NR	S	1			1	0.8	20/20
R	R	NR	S	S	S	3			3	2.4	20/20
R	R	NR	S	NR	S	1			1	0.8	16/16
NR	NR	R	S	S	S	0	1		1	0.8	12/12
NR	NR	NR	S	S	NR	2			2	1.6	8/8
NR	NR	R	S	S	S	1			1	0.8	16/16
snp	snp	snp	snp	snp	snp	2	1	11	14	11.3	ungraded
Total						78	31	15	124	100.0	

snp: sample not normally processed, R: resistant, I: intermediate, S: susceptible

Morganella species are rarely associated with septicemia and nosocomial outbreaks.

Urinary tract infections (UTIs) among elderly are very common and are considered within the context of complicated UTI. In the elderly (particularly those in community care facilities), the major contributing factors to infection are chronic neurologic illnesses with an associated neurologic bladder.⁶

Urease producing organisms are frequently isolated in complicated UTI. The effect of urease on ammonia in urine may produce highly alkaline urine which may be associated with a lower level of pyuria because of more

ANTIMICROBIAL SUSCEPTIBILITY

Susceptibility testing should be performed in accordance with the latest CLSI guidelines.⁵ The suggested first line agents include amoxicillin, trimethoprim, cefalexin (or other oral cephalosporins), nitrofurantoin, and ciprofloxacin.²

The choice of supplementary agents to test will depend upon local antibiotic policies and resistance patterns.

M. morganii produce chromosomally mediated inducible AmpC beta-lactamases and therefore are resistant to penicillin, ampicillin, ampicillin/sulbactam, oxacillin, first-generation and second-generation cephalosporins, erythromycin, colistin, and polymyxin B. Most strains are also resistant to nitrofurantoin but are usually susceptible to aminoglycosides, trimethoprim-sulfamethoxazole, quinolones and carbapenems. Although in vitro testing may indicate that *M. morganii* is susceptible to 3rd generation cephalosporins, therapeutic failure may

occur. There are currently no CSLI guidelines for reporting AmpC's but some laboratories choose to direct therapy by providing a comment that indicates resistance may develop during treatment. CMPT supports the use of a comment to indicate that this organism may produce inducible beta-lactamase.

Only rare isolates of *M. morganii* have been shown to produce extended-spectrum beta-lactamases (ESBLs).

REFERENCES

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