Trends in the Antimicrobial Resistance of *Serratia* Isolates Collected from Sunnybrook Health Sciences Centre Inpatients

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BACKGROUND

Serratia spp. are opportunistic environmental pathogens that cause a variety of nosocomial infections. These bacteria exhibit intrinsic resistance to many β-lactam/β-lactamase inhibitor combinations and early generation cephalosporins.

Data from the Canadian Nosocomial Infection Surveillance Program (CNISP) suggest the prevalence of *Serratia* isolates harboring SME-type carbapenemases increased by a factor of 10 from 2010 to 2014. However, published data describing longitudinal trends for *Serratia* resistance rates are scarce.

This novel study evaluated resistance patterns of *Serratia* isolates at a large Canadian tertiary care centre.

OBJECTIVE

To identify changes in antimicrobial resistance patterns of *Serratia* clinical isolates collected at Sunnybrook Health Sciences Centre (SHSC) between 2002–2016.

METHODS

Susceptibility data for clinical isolates of *Serratia* collected from inpatients at SHSC Bayview campus between October 2002 and September 2016 were extracted from the SHSC Microbiology database.

Linear regression was used to evaluate trends in ertapenem, meropenem, piperacillin/tazobactam, ceftazidime, ceftriaxone, ciprofloxacin, co-trimoxazole, gentamicin, and tobramycin resistance at a significance level of 0.05.

RESULTS

A total of 1082 unique *Serratia* clinical isolates were identified. The majority of isolates were obtained from blood (20%), urine (24%), and respiratory (33%) samples. Most isolates were collected from patients admitted to Level 3 ICUs (43%) and greater than 48 hours after admission (72%).

S. marcescens was the most prevalent species identified (95%); other species included *S.liquefaciens, S.odorifera, S.rubidaea, S.fonticola, S.plymuthica,* and undifferentiated *Serratia* spp.

Nineteen percent of isolates exhibited resistance to a therapeutically active antibiotic agent, with 5% of isolates being multidrug resistant.

Among the 221 isolates collected between 2010 to 2016 and tested for carbapenem susceptibility, 1 exhibited ertapenem-resistance and 1 exhibited meropenem-resistance.

No statistically significant changes in susceptibility were detected across the study period.

Susceptibility to ertapenem (~100%), meropenem (~100%), piperacillin/tazobactam (~97%), ceftazidime (~99%), ceftriaxone (~99%), ciprofloxacin (93%), co-trimoxazole (~99%), gentamicin (99%), and tobramycin (~92%) were stable across the 14-year study period.

RESULTS

Table 1: Number of *Serratia* isolates collected from inpatients between October 2009 and September 2016 with carbapenem-sensitive and carbapenem-resistant phenotypes

	2009-2010	2010-2011	2011-2012	2012-2013	2013-2014	2014-2015	2015-2016
Ertapenem-sensitive (n)	28	31	34	34	35	29	28
Ertapenem-resistant (n)	0	0	0	1	0	0	0
Meropenem-sensitive (n)	28	31	34	35	35	30	28
Meropenem-resistant (n)	0	0	0	0	0	1	0

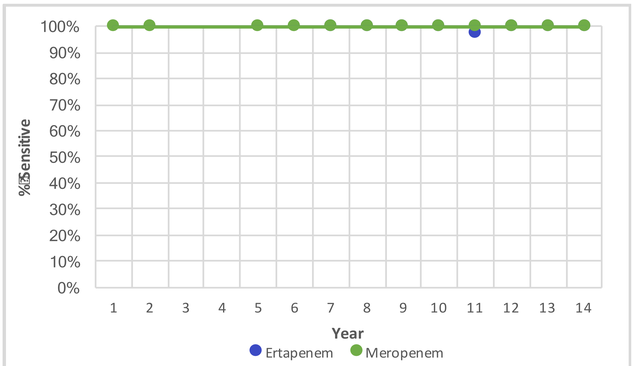

Figure 1. Percentage of *Serratia* isolates sensitive to ertapenem and meropenem each year between October 2002 to September 2016.

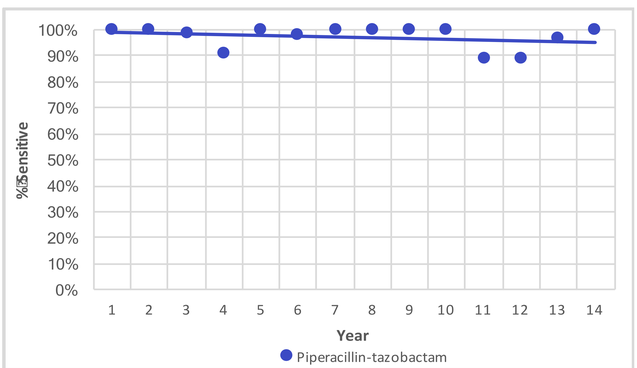

Figure 2. Percentage of *Serratia* isolates sensitive to piperacillin-tazobactam each year between October 2002 to September 2016.

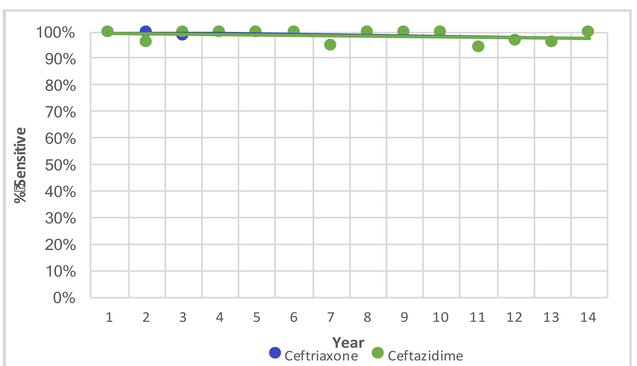

Figure 3. Percentage of *Serratia* isolates sensitive to ceftriaxone and ceftazidime each year between October 2002 to September 2016.

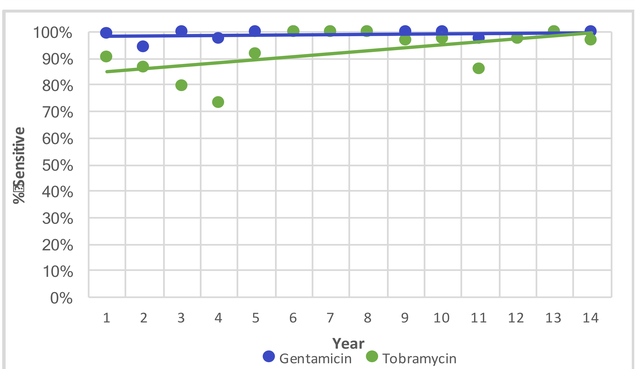

Figure 4. Percentage of *Serratia* isolates sensitive to gentamicin and tobramycin each year between October 2002 to September 2016.

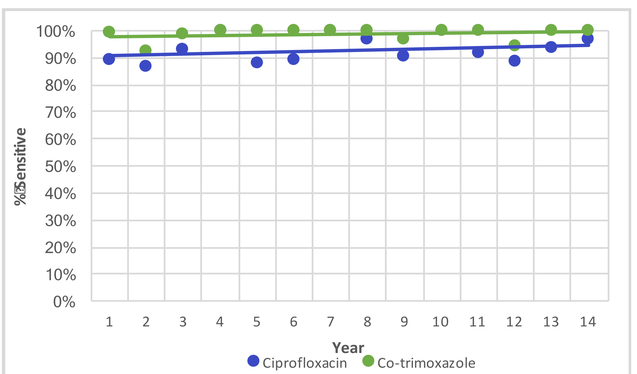

Figure 5. Percentage of *Serratia* isolates sensitive to ciprofloxacin and co-trimoxazole each year between October 2002 to September 2016.

DISCUSSION

Study is one of the first in Canada to evaluate trends in antimicrobial resistance of *Serratia* isolates to specific antibiotic agents over an extended period of time.

Very few isolates exhibited carbapenem-resistance, and the prevalence of carbapenem resistance was stable over time. High rates of *Serratia* susceptibility to piperacillin/tazobactam, 3rd generation cephalosporins, aminoglycosides, ciprofloxacin, and co-trimoxazole were observed across the 14-year study period.

Limitations:

- As a single center study, the resistance patterns observed among SHSC isolates may not be representative of isolates at other healthcare institutions.
- Study reports changes in the percentage of resistant isolates to individual antibiotic agents over time, but changes in patterns of multi-drug resistance were not assessed.
- Simple linear regression was used to characterize changes in susceptibility over time. However, yearly data points are not independent, and the statistical significance of findings may change once autocorrelation is incorporated into mathematical models.

CONCLUSION

SHSC *Serratia* clinical isolates exhibited low and stable resistance rates to all antimicrobials assessed over the 14-year study period, with only 5% having multidrug resistance.

The continued low risk of antimicrobial resistance with *Serratia* spp. in a setting of an overall global rise in antimicrobial resistance provides some optimism in an otherwise bleak story.

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DISCLOSURES

No author has any conflict of interest related to this study

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