Poster # 948

Impact of a multi-pronged approach to improve antibiotic usage on the vascular ward at a tertiary hospital

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Background

- Up to 50% of inpatient antibiotic use may be inappropriate per a cross-sectional prevalence survey in the United States.[1]
- Surgical wards do worse than medical wards for concordance to antimicrobial prescribing guidelines; surgical patients are given antibiotics more frequently and for a longer duration compared to others in a prospective cohort study.[2]
- In our hospital, the vascular ward has one of the highest consumption of broad-spectrum antibiotics.
- While audit and feedback by antimicrobial stewardship (AMS) pharmacists has been shown to be effective on medical wards, the main barrier is the inability to engage with surgeons directly on the ward due to their variable work schedules.[3]
- In an international survey designed to evaluate AMS in surgery, only half of the responding hospitals have a surgeon as part of a multidisciplinary AMS team.[4] At our site, the vascular surgeons are not formally involved in an AMS program.
- We hypothesized that increased engagement of team members, which include the local head of vascular surgeons, nurse practitioner (NP) and ward pharmacist, to AMS activities will translate to improved long-term antibiotic usage on the ward.

The objectives of our study are to:

1. Develop and implement local strategies to embed AMS within the surgical team on the vascular unit.
2. Describe the impact of these strategies to improve antibiotic use.

Methods

Setting	Tertiary hospital: 446 beds in British Columbia, Canada Vascular ward: 34 beds
Staffing	1 full-time AMS pharmacist, 1 AMS medical director, and 4 infectious diseases (ID) physicians. Surgical team: 4 vascular surgeons, 1 NP, and 1 ward pharmacist
Inclusion criteria	All patients admitted to the vascular surgery ward for any vascular related issues, and who received piperacillin-tazobactam or a carbapenem
Exclusion criteria	Patients admitted to the ward for < 48 hours
Interventions	1. Two educational sessions were provided to the surgical team. 2. Twice-weekly audit and feedback by an AMS pharmacist to a NP. She acts as a liaison between AMS and the surgeons since they have rounds throughout the day. 3. Daily rounds with ward pharmacist on all patients on broad spectrum antibiotics. 4. Mandatory ID consultation for carbapenem only if AMS recommendations were not accepted.
Primary outcome	Appropriateness of carbapenem and piperacillin-tazobactam • Criteria for carbapenem: severe gram-negative infections resistant to other antibiotics, or when other antibiotics are contraindicated (e.g. severe allergic reactions). • Criteria for piperacillin-tazobactam: treatment of sepsis or severe infections
Secondary outcome	Consumption of carbapenem and piperacillin-tazobactam
Timeline	Pre-intervention period: March 2020 to June 2020 Intervention period: July 2020 to February 2021 Sustainability period: March to June 2021 - Data collection stopped, but the interventions continued. Balancing measure: ceftriaxone consumption during the study period.
Analysis	Primary outcome: descriptive analysis Antibiotic consumption (days of therapy (DOT)/1000 patient-days): generated from AMS software (Lumed, Quebec, Canada). This is displayed using control charts (X-chart), generated by statistical process control software (QI Charts 2.0). We used established rules for differentiating special- versus common-cause variation for control charts.[5]

Results

Pre-intervention period: 19 out of 25 prescriptions (76%) had appropriate indications.
Intervention period: 121 prescriptions reviewed; appropriateness increased to 87% (Figure 1).

- The mean DOT per 1000 patient-days for carbapenem decreased from 94.6 to 56.6 for pre- and intervention periods, respectively (Figure 2); it represents common-cause variation.
- For piperacillin-tazobactam, the mean DOT per 1000 patient-days decreased from 209.9 to 138.5 for pre- and intervention periods. There were a run of > 8 points in a row below the center line, signifying special-cause variation. This trend remained sustainable (Figure 3).
- During the same period, the usage of ceftriaxone has gone up. The overall use of broad-spectrum antibiotics (combining ceftriaxone, piperacillin-tazobactam and carbapenem) didn't change with the interventions (figure not shown).

Figure 1: Summary of patient characteristics and outcomes during intervention period (July 2020 to February 2021)

Number of patients reviewed	114
Included patients: 97 Excluded patients: 17 Reasons for exclusion (number of patients): • Admitted for non-vascular issues (15) • Was vascular patient, but transferred to the intensive care unit subsequently (1) • Patient left against medical advice within 48 hours of admission (1)	
Patient characteristics (n=97)	
Age (average)	69.7 years
Sex (male)	73 (75 %)
Types of procedure(s) performed (n=97)	
Amputation	30
Revascularization	31
Amputation and revascularization	23
Others (e.g. debridement)	9
None required	4
Outcomes based on the number of prescriptions for included patients (n=121)	
Indication for antibiotic(s)	Prophylaxis: 12 Treatment: 109
Antibiotic(s) used	Carbapenem: 30 (meropenem: 28; imipenem-cilastatin 2) Piperacillin-tazobactam: 91
Appropriateness for carbapenem	25/30 appropriate (83 %)
Appropriateness for piperacillin-tazobactam	80/91 appropriate (88 %)
Overall appropriateness = 105/121 (87 %)	
Number of AMS suggestions Acceptance rate	51/121 prescriptions required intervention (42 %) 45 /51 interventions were accepted (88 %)
Patient safety outcomes	
Hospital readmission within 30 days post-operation (OR)	11 patients 37 patients were still admitted at 30-day post OR
C. difficile within 30 days post OR	5/97 patients (5 %)
30-day all-cause mortality (post OR)	4/97 patients (4 %)

*Patients can have > 1 course of antibiotic during the same admission.

Figure 2: Usage of carbapenem from June 2019 to June 2021

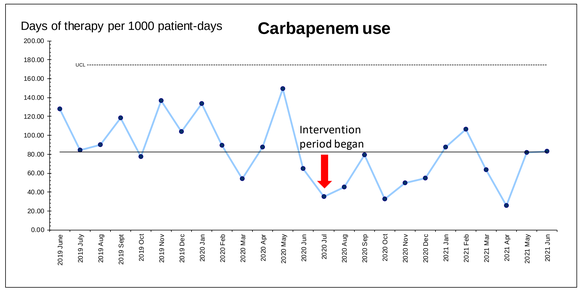
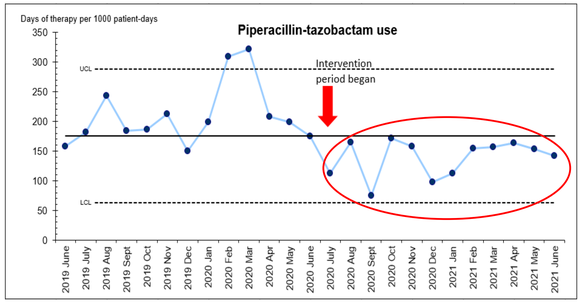


Figure 3: Usage of piperacillin-tazobactam from June 2019 to June 2021



Discussion and Conclusion

- The appropriateness of targeted antibiotics increased from 76% to 87% during the 8-month study period.
- While piperacillin-tazobactam usage decreased, this was offset by an increase in ceftriaxone use. This trend was not surprising since we educated the surgeons to preserve piperacillin-tazobactam for severe infections or when *Pseudomonas* coverage is needed.
- In the past, surgeons indicated that the reason for using carbapenem or piperacillin-tazobactam instead of narrower spectrum antibiotics is due to fear of antibiotic failure. None of the deaths in this study were related to surgical site infections.
- **Strength**: Almost 90% of AMS suggestions were accepted, and only a few mandatory ID consults were required. Prescribers generally prefer persuasive measure instead of restriction as it preserves their autonomy.
- **Limitation**: 17 patients were excluded, but we were unable to extract their data from the antibiotic consumption graphs designed for the entire ward; these graphs overestimated the actual use of antibiotics for vascular patients.

Conclusion: A multi-pronged approach, consisting of education, prospective and audit feedback to the surgical team, and mandatory ID consult in selected cases, is effective in decreasing inappropriate broad-spectrum antibiotic use on the vascular ward at a tertiary site.

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