



Original Research Article

Antimicrobial-Stewardship Interventions in The Context of Antibiotic Prophylaxis in General Surgery: Evaluation of Procedures and Outcomes

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Abstract: Antimicrobial stewardship (AMS) programs are increasingly fundamental in optimizing the use of antibiotic prophylaxis during general surgical procedures. This research evaluates the implementation of AMS interventions in general surgery, their impact on the appropriateness of surgical antibiotic prophylaxis (SAP), and the clinical outcomes, including surgical site infection (SSI) rates, antibiotic utilization, and economic implications. Through an extensive review of peer-reviewed studies and the inclusion of recent outcome data from intervention trials, this article presents a synthesis of best practices, challenges, and measurable benefits associated with AMS in the operating room.

Keywords: Surgical site infections (SSIs), Prophylactic antibiotics, antimicrobial resistance, Antimicrobial stewardship (AMS), Surgical antibiotic prophylaxis (SAP).

INTRODUCTION

The administration of antibiotics for the prevention of surgical site infections (SSIs) has long been a cornerstone of perioperative care. However, misuse and overuse of prophylactic antibiotics contribute to antimicrobial resistance, unnecessary adverse events, and increased healthcare expenditure. AMS initiatives in surgical settings aim to ensure that SAP is appropriately indicated, timed, selected, and discontinued, thereby improving patient outcomes and minimizing resistance^{[1][2]}.

BACKGROUND: ANTIBIOTIC PROPHYLAXIS AND THE CHALLENGE OF STEWARDSHIP

- SSIs remain among the most common healthcare-associated infections, representing a heavy burden in terms of morbidity, mortality, and cost.
- Optimizing SAP involves:
 - Correct indication for antibiotics.
 - Selection of appropriate agents.
 - Accurate timing and dosing.

- Limiting duration of therapy.
- Studies have documented poor compliance with accepted guidelines on SAP in terms of dosing, timing, and duration, driving the need for AMS interventions^{[3][4]}.

METHODS

A literature review of major AMS interventions from 2010 to 2024 was conducted, focusing on studies with outcomes in general surgery. Process and clinical quality indicators, antibiotic consumption, cost savings, and changes in rates of SSIs before and after interventions were extracted and analyzed to draw comprehensive conclusions.

Types of AMS Interventions in Surgical Prophylaxis

- 1. **Guideline Development and Clinical Pathway Revision**
 - Creation and implementation of hospital or national guidelines for SAP.
 - Integration of evidence-based algorithms into surgical workflows.
 - Routine revision of clinical pathways identified as outdated or non-compliant^{[1][2][5]}.
- 2. **Audit and Feedback**
 - Internal audits measuring compliance with SAP protocols.
 - Real-time or periodic feedback to surgical, anesthesiology, and pharmacy teams.
- 3. **Educational Campaigns**
 - Targeted education for surgical staff regarding the risks of inappropriate SAP use and the principles of stewardship.
- 4. **Pharmacy-Driven Interventions**
 - Empowering pharmacy teams to review, adjust, or halt unnecessary antibiotic orders^[2].

RESULTS: IMPACT OF ANTIMICROBIAL STEWARDSHIP INTERVENTIONS

Improvements in Appropriateness and Compliance

A 2018 quasi-experimental study involving 41,426 clean surgical procedures demonstrated significant improvements after AMS implementation:

Indicator	Pre-Intervention	Post-Intervention
Prophylactic antibiotic use (%)	82.9	28.0
Antibiotics given within 120 min of incision (%)	20.8	85.1
Discontinuation within 24 hours (%)	22.1	60.4
Appropriate antibiotic selection (%)	37.0	93.6
SSI Rate (%)	0.7	0.5
Antibiotic consumption (DDD/100 bed-days)	74.9	34.2

Duration and Choice of Antibiotics

- After optimizing 35 out of 171 clinical pathways, the median duration of SAP was reduced from 3 to 2 days.
- Antibiotic discontinuation within 48 hours post-surgery improved from 62.4% to 81.8%.
- The incidence of SSIs did not increase (5.7% pre-revision vs. 4.3% post-revision)^[1].

Drug Utilization and Economic Impact

- Switch from broad-spectrum (e.g., ceftriaxone) to narrower-spectrum (e.g., cefazolin) antibiotics increased.
- Antibiotic consumption and associated costs decreased.
- Hospitals demonstrated economic and clinical benefit without compromising patient safety^{[1][4]}.

DISCUSSION

Clinical and Economic Benefits

- AMS programs result in more appropriate SAP, with significant reductions in antibiotic consumption, decreased rates of inappropriate prolonged prophylaxis, and cost-savings—even in resource-constrained settings^{[1][4][5]}.

- Multiple studies report no significant change—or a reduction—in SSI rates after stewardship interventions, dispelling fears that conservative SAP practices may compromise surgical outcomes^{[1][2][3]}.

Barriers to Effective Implementation

- Incomplete adherence to guidelines persists, often due to:
 - Entrenched prescribing habits.
 - Lack of real-time feedback.
 - Gaps in staff education.
- Overlapping therapeutic and prophylactic indications may lead to redundant antibiotics, highlighting a need for better communication among clinical teams (e.g. concurrent treatment and prophylaxis during surgery)^[2].

Long-Term Strategies

- Regular audit cycles, continuous education, and institutional support are required for sustained success.
- Incorporating stewardship as a required element in surgical quality improvement projects leads to sustained improvements and improved awareness of antimicrobial resistance risks^[3].

Graphical Representation of AMS Outcomes in General Surgery

Figure 1: Improvements in Key SAP Compliance Indicators Following AMS Implementation

- Prophylactic antibiotic use, timely administration, discontinuation, and appropriate selection all improved after intervention—a trend consistent among reviewed studies^{[1][4]}.

CONCLUSION

AMS interventions in general surgery have shown measurable benefits in optimizing antibiotic use for surgical prophylaxis, reducing unnecessary exposures, improving patient safety, and generating health system savings. To maximize these benefits, a multifaceted stewardship approach—integrating guideline enforcement, ongoing education, regular auditing, and pharmacy oversight—should be implemented as standard of care in all surgical units.

Recommendations

- Develop and regularly update SAP guidelines according to evolving evidence.
- Institute real-time audit and feedback mechanisms.
- Empower pharmacy and infection control teams for active stewardship.
- Educate all perioperative staff on rational antibiotic use and the dangers of resistance.
- Monitor clinical outcomes continuously to ensure patient safety is maintained.

Illustrative Table: Outcomes Before and After AMS in General Surgery

Outcome	Pre-Intervention	Post-Intervention
SAP Appropriateness (%)	37	93.6
Timely prophylaxis (%)	20.8	85.1
SSI Rate (%)	0.7	0.5
Antibiotic consumption	74.9 DDD	34.2 DDD
Costs (relative)	High	Lower

For visualization, bar graphs depicting these indicators can be presented for effective comprehension by surgical and stewardship teams.

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