

Characterization and Treatment of *Staphylococcus aureus* Nosocomial Pneumonia at a Tertiary Care Hospital



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Background

- Hospital-acquired pneumonia (HAP), including ventilator-associated pneumonia (VAP), is the second most common nosocomial infection in Canada¹
- Staphylococcus aureus* (*S. aureus*) HAP and VAP is associated with mortality rates as high as 41% and 56% for MSSA and MRSA^a respectively²
- IDSA, AMMI, and ERS^b guidelines recommend 7-8 days of antibiotic therapy for HAP/VAP regardless of causative bacteria³
- Anecdotal observation at Royal Columbian Hospital (RCH) suggests possible treatment failure with standard regimens

^a MSSA: Methicillin-sensitive *Staphylococcus aureus*, MRSA: Methicillin-resistant *Staphylococcus aureus*
^b IDSA: Infectious Diseases Society of America, AMMI: Association of Medical Microbiology and Infectious Disease Canada, ERS: European Respiratory Society

Objectives

Primary Objectives

- To characterize the treatment of MSSA and MRSA HAP and VAP infections at RCH

Secondary Objectives

- To determine the incidence of MSSA and MRSA nosocomial pneumonia
- To assess length of hospital stay, time to extubation, treatment failure, and mortality in MSSA and MRSA HAP and VAP
- To determine the occurrence of complications and superimposed infections associated with *S. aureus* HAP and VAP

Study Design

- Retrospective chart review for patients diagnosed with HAP or VAP at RCH between Jan 1, 2012 – Sept 30, 2020
- Inclusion criteria:**
 - ≥ 18 years old
 - Diagnosis of HAP or VAP
 - Laboratory confirmed *S. aureus* in sputum
- Exclusion criteria:**
 - Admitted to hospital < 48 hours
 - Presumed *S. aureus* colonization not requiring therapy
 - Comfort care orders within 48 hours after beginning standard treatment for *S. aureus* HAP or VAP
- Statistical analysis:** Descriptive statistics

Definitions

Clinical Cure: resolution or return to baseline signs and symptoms, not requiring additional antibiotic therapy for pneumonia within 30 days, absence of worsening on radiographic imaging³
Treatment Failure: recurrence within 30 days, mortality associated with pneumonia, replacing treatment with broader spectrum antibiotic⁴
Recurrence: infection from the same initial causative organism within 30 days after discontinuing antibiotics for ≥ 72 hours or negative sputum culture^{3,5}
Appropriate Antibiotic Therapy: guideline endorsed antibiotic selection and adequate coverage of suspected/cultured organism

Table 1. Baseline Characteristics (n = 75)

Median Age in Years (Range)	64 (19 – 89)
Male no.	60 (80%)
Baseline Immunosuppression	4 (5.3%)
Intensive Care Unit (ICU)	69 (92%)
High Acuity Unit (HAU)	1 (1.3%)
Internal Medicine, Surgery or other non-ICU or HAU wards	5 (6.7%)
Mechanical Ventilation no.	63 (84%)

Table 2. Diagnosis of HAP and VAP (n = 75)

Median Days in Hospital Prior to Diagnosis (Range)	9 (3 – 64)
Fever (> 38°C)	39 (52%)
Mean WBC (x 10 ⁹ /L) ± SD	13.6 ± 5.6
Presence of Consolidation on CXR	55 (73.3%)
Increased O ₂ Requirements	52 (69.3%)
Bacteremia	8 (10.7%)
Concurrent influenza	1 (1.3%)
Empyema, Abscess, Cavitation	7 (9.3%)
Complicated ^c	21 (28%)

^c Multi-organ involvement, bacteremia, line infection, polymicrobial

Figure 1. Sputum Culture Microbiology

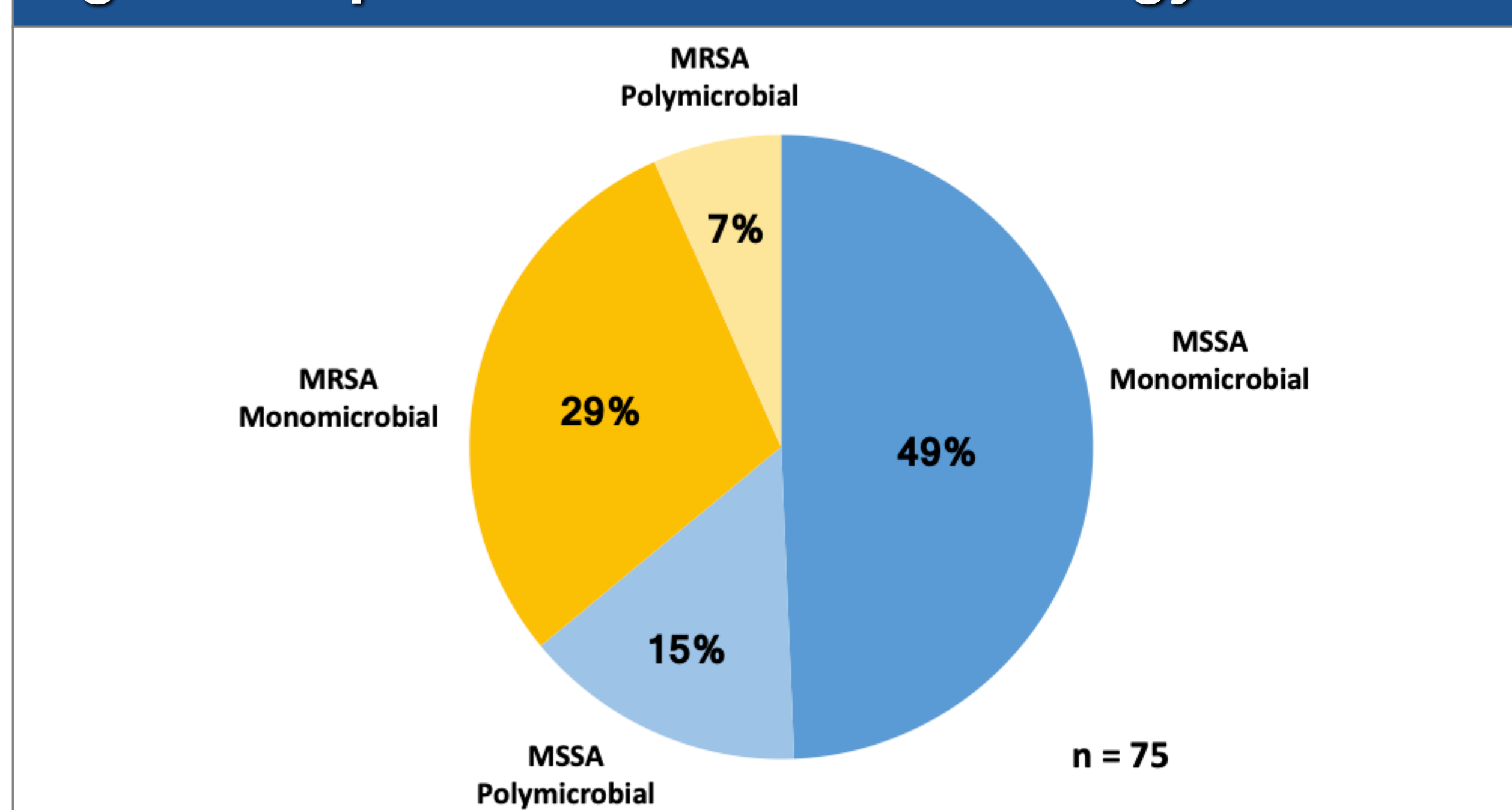


Figure 2. Appropriateness of Antibiotic Therapy

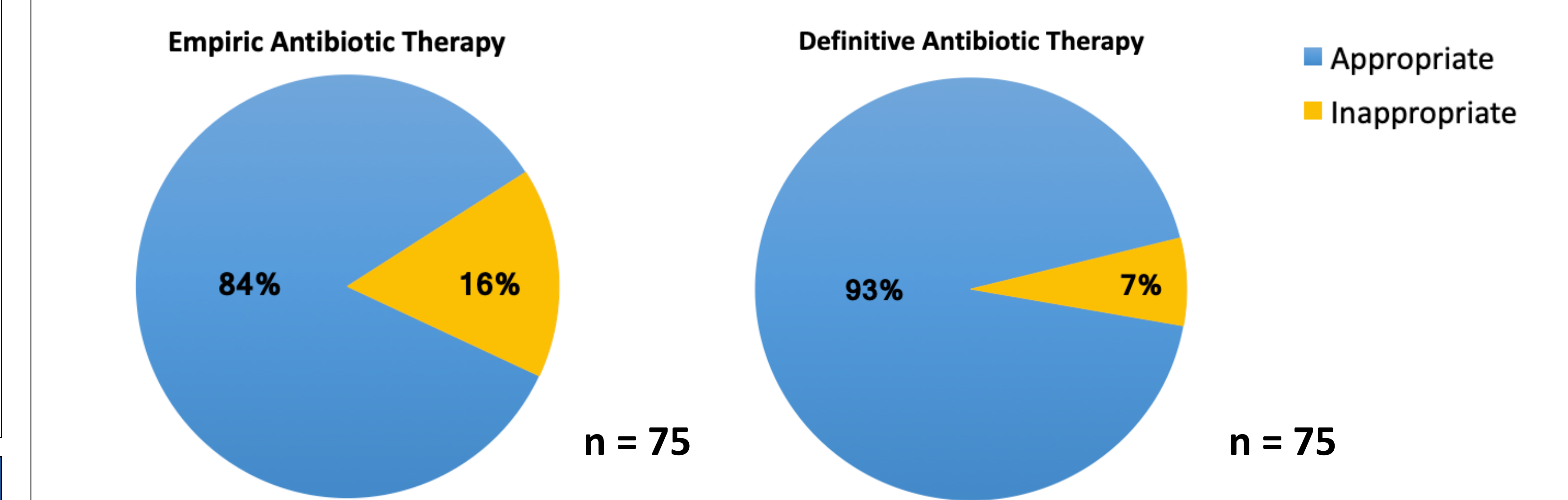


Table 3. Outcomes (n = 75)

Mean Duration of Antibiotics (Days) ± SD	15.4 ± 9.1	
Median Bacteremia Clearance in Days (Range)	4 (1 – 4)	
	Eight Days or Less of Antibiotic Therapy (n = 16)	Greater than Eight Days of Antibiotic Therapy (n = 59)
Mean Duration of Antibiotics (Days) ± SD	6.9 ± 1.2	17.7 ± 8.9
Antibiotic Treatment Interruptions (< 48 hours)	4 (25%)	2 (3.4%)
Clinical Cure	11 (68.7%)	49 (83.1%)
Empyema, Abscess or Cavitation	2 (12.5%)	5 (8.5%)
Recurrence	4 (25%)	13 (22%)
Treatment Failure	5 (31.3%)	10 (16.9%)
Mortality	5 (31.3%)	16 (27.1%)
Median Time of Hospital Stay (Range)	31.5 (12 – 179)	45 (11 – 419)
Patients Requiring Mechanical Ventilation (n = 63)		
Median Time to Extubation in Days (Range)	11 (3 – 178)	15 (1 – 402)
	13 (1 – 402)	

Limitations

- Retrospective chart review and small sample size
- Treatment interruptions for up to 48 hours were included in duration of therapy
- Serum procalcitonin was not consistently ordered

Conclusions

- Patients experienced a higher incidence of MRSA pneumonia than suggested by local antibiograms
- Inappropriate antibiotics was driven by the absence of *S. aureus* coverage
- Patients overall received longer treatment durations independent of antibiotic selection and culture
- Patients receiving eight days or less of antibiotics demonstrated a lower clinical cure rate and increased treatment failures
- Future randomized-control trials may help clarify the optimal duration of therapy

References

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