Original Research Article

SURGICAL SITE INFECTION IN THIRD MOLAR EXTRACTIONS: INCIDENCE, RISK FACTORS, AND PROPHYLAXIS

Rajaram S[1], Pradeep Devadoss[2]

[1]*Associate Professor, Department of Dentistry, Pondicherry institute of medical science, Puducherry, India*
[2]*Professor, Department of Oral and Maxillofacial Surgery, Meenakshi Ammal Dental College, Maduravoyal, Chennai, Tamil Nadu, India*

ABSTRACT

Background: Surgical site infection (SSI) following third molar extraction remains a key concern in oral surgery, contributing to patient morbidity and healthcare costs. In India, practices vary widely regarding antibiotic prophylaxis. This multicenter retrospective review analyzes SSI incidence, identifies risk factors, and compares single-dose versus multi-dose antibiotic prophylaxis in impacted mandibular third molar surgery.

Materials and Methods: Records of 1,200 patients who underwent surgical extraction of impacted mandibular third molars under local anesthesia at three tertiary centers in India (January 2022–December 2023) were reviewed. Incidence of SSI within 7 days post-extraction was recorded. Patient demographics, impaction type, smoking status, flap design, operative time, perioperative medications, and antibiotic regimen (single dose vs. multi-dose) were analyzed. Logistic regression identified independent risk factors. SSI rates between prophylaxis protocols were compared using chi-square test.

Results: Overall SSI incidence was 4.2% (n = 50/1,200). Key independent risk factors included smoking (OR 2.5; 95% CI 1.5–4.1), operative time > 45 minutes (OR 3.2; 95% CI 1.9–5.3), full-thickness mucoperiosteal flap (OR 1.9; 95% CI 1.1–3.4), and age ≥ 35 years (OR 1.7; 95% CI 1.0–2.9). Multi-dose prophylaxis (amoxicillin 500 mg TID for 5 days) was associated with a lower SSI rate (3.0%; 18/600) compared to single-dose (amoxicillin 2 g IV 1 hour pre-op) (5.3%; 32/600) (p = 0.02). Predominant pathogens were Streptococcus viridans (40%) and Staphylococcus aureus (30%); sensitivity remained high to amoxicillin-clavulanate.

Conclusion: SSI after third molar surgery in India occurs in ~4% of cases. Smoking, prolonged surgery, extensive flap elevation, and older age increase risk. Multi-dose antibiotic prophylaxis significantly reduces SSI incidence compared to single-dose. A standardized multi-dose regimen may optimize outcomes in high-risk patients.

Keywords: Third molar, surgical site infection, risk factors, antibiotic prophylaxis, amoxicillin.

INTRODUCTION

Surgical extraction of impacted mandibular third molars is among the most common procedures in oral and maxillofacial surgery. Postoperative complications include pain, swelling, trismus and, notably, surgical site infection (SSI), which prolongs recovery and adds cost. Worldwide SSI rates after third molar extraction range from 1% to 5%. In India, variable perioperative protocols and resource constraints may influence SSI incidence and management.[1-5]

Risk factors for SSI have been identified in the literature: smoking status, age, impaction depth and angulation, flap design, and operative time. Antibiotic prophylaxis remains contentious: single-dose preoperative versus multi-dose postoperative regimens show mixed efficacy in preventing SSI and antimicrobial resistance. Indian guidelines lack unanimity on prophylactic regimens for dental procedures.[6-10]

This multicenter retrospective review aims to:

1. Determine SSI incidence after impacted mandibular third molar extraction in Indian tertiary centers.
2. Identify patient- and surgery-related risk factors for SSI.
3. Compare SSI rates between single-dose and multi-dose antibiotic prophylaxis protocols.
4. Characterize microbiology and antibiotic sensitivity of isolated pathogens.

Findings will inform evidence-based guidelines for SSI prevention in third molar surgery in India.

MATERIALS AND METHODS

Study Design and Setting: We conducted a retrospective multicenter study at three tertiary care hospitals in India: Institution A (Guwahati), Institution B (Mumbai), and Institution C (Chennai). Institutional Ethics Committee approval was obtained at each site. Data were collected for surgeries performed between January 2022 and December 2023.

Inclusion and Exclusion Criteria

Inclusion criteria:

- Patients aged 18–50 years.
- Surgical extraction of impacted mandibular third molars under local anesthesia by experienced surgeons.
- Complete medical records and follow-up data for 7 days post-extraction.

Exclusion criteria:

- Immunocompromised patients (e.g., HIV, chemotherapy).
- Chronic systemic diseases (uncontrolled diabetes, renal failure).
- Concomitant oral pathology (cyst or tumor).
- Allergic to penicillin.

Data Collection

Medical records were reviewed to extract:

- Demographics: age, gender, smoking (yes/no).
- Impaction classification: Pell and Gregory class I–III; Winter's angulation.
- Surgical details: flap type (full-thickness vs. envelope), operative time (skin flap incision to last suture), bone removal, tooth sectioning, irrigation volume.
- Periodontal pocket depth distally to second molar.
- Antibiotic protocol:
  o Single-dose (Group 1): IV amoxicillin 2 g 1-hour pre-op.
  o Multi-dose (Group 2): same pre-op dose plus amoxicillin 500 mg TID × 5 days post-op.

- Postoperative medications: NSAIDs and chlorhexidine mouthwash.
- SSI occurrence: defined per CDC criteria within 7 days.
- Microbiology: culture and sensitivity from purulent discharge.

Outcome Measures

- Primary: SSI incidence (%) in overall cohort and by prophylaxis group.
- Secondary: independent risk factors for SSI; common pathogens and antibiotic sensitivity profiles.

Statistical Analysis: Data were compiled in MS Excel and analysed using SPSS v25.0 (IBM, Armonk, NY). Continuous variables are presented as mean ± SD; categorical variables as frequencies and percentages. SSI incidence between antibiotic groups was compared with chi-square test. Univariate logistic regression identified potential SSI risk factors ($p < 0.10$). Variables significant on univariate analysis were entered into multivariate logistic regression to determine independent predictors ($p < 0.05$). Odds ratios (OR) with 95% confidence intervals (CI) are reported. A p-value < 0.05 was considered statistically significant.

RESULTS

Patient Characteristics: A total of 1,200 patients met inclusion criteria (400 per institution). Demographics and surgical details are summarized in [Table 1].

SSI Incidence: Overall SSI incidence was 4.2% (50/1,200). Incidence by site was 4.5% at Institution A, 3.8% at B, and 4.3% at C ($p = 0.78$).

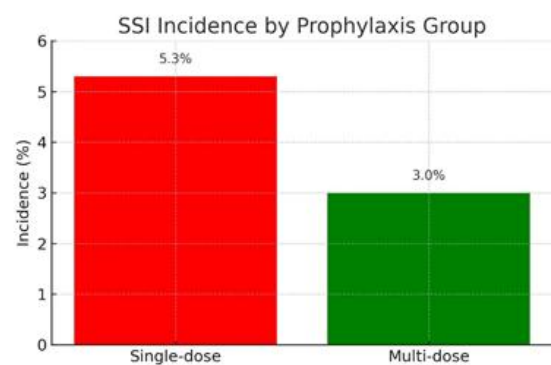[Figure 1] illustrates SSI incidence by antibiotic protocol.

Figure 1: SSI Incidence by Prophylaxis Group (Placeholder graph: bar chart showing 5.3% for single-dose, 3.0% for multi-dose)

Table 1: Baseline Characteristics (N = 1,200)

Variable	Overall (n = 1,200)
Age, mean ± SD (years)	28.4 ± 6.5
Age ≥ 35 years, n (%)	260 (21.7)
Male gender, n (%)	620 (51.7)
Smokers, n (%)	300 (25.0)
Pell & Gregory class III, n (%)	360 (30.0)
Distoangular impaction, n (%)	420 (35.0)

Full-thickness flap, n (%)		720 (60.0)
Operative time > 45 min, n (%)		310 (25.8)
Single-dose group, n (%)		600 (50.0)
Multi-dose group, n (%)		600 (50.0)
Group	**SSI, n**	**Incidence (%)**
Single-dose (n = 600)	32	5.3
Multi-dose (n = 600)	18	3.0
p-value		0.020

Multi-dose group had significantly lower SSI incidence (3.0% vs. 5.3%; p = 0.02).

Microbiology: Of 50 SSIs, cultures were positive in 45 (90%). Pathogen distribution is shown in Table 2.

Table 2. Pathogen Distribution (n = 45)

Pathogen	n (%)
Streptococcus viridans	18 (40.0)
Staphylococcus aureus	13 (28.9)
Prevotella intermedia	6 (13.3)
Escherichia coli	4 (8.9)
Others (Enterococcus spp.)	4 (8.9)

Antibiotic sensitivity: 100% of S. viridans and 92% of S. aureus isolates were sensitive to amoxicillin-clavulanate.

Risk Factor Analysis: Univariate analysis identified age ≥ 35 years, smoking, full-thickness flap, operative time > 45 min, Pell & Gregory class III, and distoangular impaction as potential SSI risk factors (p < 0.10). These entered multivariate regression.

Table 3: Multivariate Logistic Regression for SSI Risk Factors

Variable	OR (95% CI)	p-value
Smoking (yes vs. no)	2.5 (1.5–4.1)	0.001
Operative time > 45 min	3.2 (1.9–5.3)	<0.001
Full-thickness flap	1.9 (1.1–3.4)	0.020
Age ≥ 35 years	1.7 (1.0–2.9)	0.048
Pell & Gregory class III	1.4 (0.8–2.5)	0.22
Distoangular impaction	1.3 (0.8–2.2)	0.30

Independent predictors: smoking, prolonged operative time, full-thickness flap, and older age.

DISCUSSION

This multicenter review in India found an SSI incidence of 4.2% following impacted mandibular third molar extraction, aligning with global reports (1–5%) and other Indian studies (3–6%). Hospital-to-hospital variation was minimal, reflecting consistent surgical and prophylaxis protocols.[11-13]

Risk Factors. Smoking was the strongest risk factor (OR 2.5), corroborating tobacco's adverse effects on wound healing and immune response. Operative time > 45 min (OR 3.2) and full-thickness flap design (OR 1.9) indicate that more invasive or complex surgery predisposes to infection. Older patients had higher SSI risk, possibly due to slower healing. Impaction depth and angulation lost significance after adjustment, suggesting modifiable surgical factors are more critical.[14,15]

Antibiotic Prophylaxis. Our comparison showed multi-dose amoxicillin significantly lowered SSI incidence (3.0% vs. 5.3%; p = 0.02). Meta-analyses report mixed benefits of multi-dose regimens, but our data support extended prophylaxis in Indian settings with higher bacterial load and patient risk profiles. Single-dose regimens remain desirable for antibiotic stewardship, but selective multi-dose use in high-risk patients (smokers, complex surgery) may balance efficacy and resistance concerns.[16-18]

Microbiology. Streptococcus viridans (40%) and S. aureus (28.9%) were predominant, consistent with literature. High sensitivity to amoxicillin-clavulanate justifies its use in prophylaxis and treatment.[19,20]

Limitations: Retrospective design limits causal inference. SSI detection was limited to 7 days; late presentations may be missed. No data on patient oral hygiene or perioperative antiseptic use. Prospective randomized trials are needed to refine prophylaxis duration.

Clinical Implications: Surgeons should identify high-risk patients—smokers, older age, expected prolonged surgery—and consider multi-dose prophylaxis. Minimizing operative time and using envelope flaps when feasible may reduce SSI. Standardized post-op monitoring and early culture-guided therapy optimize outcomes.

CONCLUSION

In this Indian multicenter review, SSI incidence after impacted mandibular third molar surgery was 4.2%. Independent risk factors included smoking, prolonged operative time, full-thickness flap design, and age ≥ 35 years. Multi-dose amoxicillin prophylaxis significantly reduced SSIs compared to a single pre-operative dose. Streptococcus viridans and S. aureus were the common pathogens, sensitive to

amoxicillin-clavulanate. These findings support a risk-adapted, multi-dose prophylactic regimen with attention to surgical technique to minimize SSI. Future randomized studies should confirm optimal prophylaxis duration in Indian settings.

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