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Impact of Preoperative Oral Health Status on Postoperative Surgical Site Infections and Hospital Length of Stay in Patients Undergoing Elective Abdominal Surgery: A Prospective Cohort Study.

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Abstract

Background: Surgical site infections (SSIs) remain a major cause of postoperative morbidity, prolonged hospitalization, and increased healthcare expenditure following abdominal surgery. While systemic host factors such as diabetes mellitus and malnutrition are well-recognized risk determinants, the role of chronic oral infectious foci—such as periodontitis, dental caries, and poor oral hygiene—as potential reservoirs for bacteremia and distant surgical site contamination remain underexplored in general surgical settings. Objective: To evaluate the association between preoperative oral health status and the incidence of postoperative surgical site infections, systemic infectious complications, and hospital length of stay among patients undergoing elective abdominal surgery. ***Methods***: A prospective observational cohort study was conducted between January and September 2026 in the Departments of General Surgery and Dentistry at Shri Balaji Institute of Medical Sciences, Raipur, Chhattisgarh, India. A total of 260 adult patients scheduled for clean-contaminated elective abdominal procedures underwent standardized preoperative dental evaluation using the Simplified Oral Hygiene Index (OHI-S), Decayed, Missing, and Filled Teeth (DMFT) index, and Community Periodontal Index (CPI). Patients were stratified into two cohorts: Group A (good-to-fair oral health, n = 142) and Group B (poor oral health/severe periodontitis, n = 118). Participants were monitored for 30 days postoperatively for SSIs according to Centers for Disease Control and Prevention (CDC) criteria. Data were analyzed using SPSS version 27.0 via chi-square tests, Mann-Whitney U tests, and multivariable logistic regression, with $p < 0.05$ considered statistically significant. ***Results***: Of the 260 patients (mean age 46.8 ±13.4 years; 56.2% male), the overall 30-day SSI incidence was 13.8% (n = 36). Patients with poor preoperative oral health exhibited a significantly higher incidence of SSIs compared to those with good-to-fair oral health (22.0% vs. 7.0%; $p < 0.001$). Secondary postoperative complications, including febrile morbidity (18.6% vs. 7.7%; $p = 0.009$) and postoperative pneumonia (6.8% vs. 1.4%; $p = 0.025$), were also markedly elevated in Group B. Median postoperative hospital length of stay was significantly longer among patients with poor oral health (7.0 days [IQR: 5–9] vs. 5.0 days [IQR: 4–6]; $p < 0.001$). Multivariable logistic regression adjusting for age, diabetes mellitus, body mass index, American Society of Anesthesiologists (ASA) class, and operative duration confirmed poor preoperative oral health as an independent predictor of SSI (adjusted odds ratio [AOR] = 3.24, 95% confidence interval [CI]: 1.46–7.18; $p = 0.004$). ***Conclusion***: Compromised preoperative oral health is an independent, modifiable risk factor for postoperative surgical site infections and prolonged hospitalization following elective abdominal surgery. Integrating routine preoperative dental screening and basic oral decontamination protocols into surgical prehabilitation pathways offers a cost-effective strategy to improve surgical outcomes.

Keywords: Abdominal surgery; Length of stay; Oral health; Periodontitis; Preoperative care; Surgical wound infection.

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INTRODUCTION

Surgical site infections (SSIs) account for approximately 20% of all healthcare-associated infections and represent the most frequent infectious complication among hospitalized surgical patients [1]. Particularly in low- and middle-income countries (LMICs), SSI rates following abdominal procedures remain substantially higher than global benchmarks, contributing to delayed wound healing, incisional hernias, secondary surgical interventions, prolonged hospital stays, and escalating out-of-pocket healthcare costs [2, 3]. Standard perioperative preventive bundles—comprising timely antibiotic prophylaxis,

glycemic control, normothermia, and skin antisepsis—have reduced infection rates, yet a considerable burden of preventable postoperative morbidity persists [4].

The oral cavity harbors one of the most complex and densely populated microbial ecosystems in the human body, comprising over 700 bacterial species [5]. In individuals with neglected oral hygiene, untreated dental caries, periapical abscesses, or chronic periodontitis, ulcerated periodontal pockets act as persistent portals of entry into the systemic circulation [6]. Routine daily activities such as mastication and toothbrushing, alongside endotracheal intubation during general anesthesia, can trigger transient bacteremia and microaspiration of pathogenic oral flora into the respiratory and gastrointestinal tracts [7, 8].

Emerging evidence across cardiac, orthopedic, and oncological surgery suggests that chronic oral inflammatory diseases amplify systemic inflammatory burden—elevating circulating C-reactive protein (CRP), interleukin-6 (IL-6), and tumor necrosis factor-alpha (TNF-\alpha)—while impairing host neutrophil function and tissue repair [9, 10]. Despite these biologically plausible mechanisms, preoperative dental clearance is routinely mandated almost exclusively prior to cardiac valve replacement, organ transplantation, or head-and-neck oncology resections. In routine general surgical practice, particularly in central India where periodontal disease and smokeless tobacco-related oral pathology are highly prevalent, the oral cavity is seldom examined during preoperative assessment [11].

Establishing whether poor preoperative oral health independently predisposes patients to postoperative infections in general abdominal surgery could justify low-cost, high-impact interdisciplinary prehabilitation protocols. Therefore, this prospective cohort study aimed to investigate the impact of preoperative oral health status on 30-day surgical site infections, postoperative infectious complications, and hospital length of stay among patients undergoing elective abdominal surgery at a tertiary care teaching hospital in Raipur, Chhattisgarh.

MATERIALS AND METHODS

2.1 Study Design and Setting

A prospective, observational cohort study was conducted over a nine-month period from January to September 2026 through a collaborative initiative between the Department of General Surgery and the Department of Dentistry at Shri Balaji Institute of Medical Sciences, Raipur, Chhattisgarh, India.

2.2 Study Population and Eligibility Criteria

Adult patients aged 18 to 75 years scheduled for elective, clean-contaminated abdominal surgery under general anesthesia (including open or laparoscopic cholecystectomy, ventral/incisional hernia repair with mesh, elective bowel resection, gastrojejunostomy, and appendectomy) were eligible for enrollment. Exclusion criteria included emergency surgical procedures, dirty or infected surgical wounds (CDC Class IV), edentulous patients wearing complete dentures, active systemic infection or preoperative antibiotic therapy within 14 days prior to surgery, severe immunosuppression (e.g., active chemotherapy, chronic corticosteroid therapy, HIV/AIDS), and refusal to provide informed consent.

2.3 Sample Size Calculation

Sample size estimation was based on comparing two independent proportions of postoperative SSI incidence between patients with poor versus good oral health. Assuming an anticipated SSI incidence of 8.0% in the good oral health cohort and 21.0% in the poor oral health cohort based on prior surgical-dental literature [12], with a two-sided significance level (\alpha) of 0.05 and 80% statistical power (1 - \beta), the minimum required sample size was calculated as 114 patients per group (228 total). Accounting for a 12% anticipated loss to 30-day follow-up, 260 patients were enrolled.

2.4 Preoperative Oral Health Assessment

Within 24 to 48 hours prior to surgery, all enrolled participants underwent a standardized clinical oral examination conducted by a calibrated dental specialist blinded to the surgical team's risk stratification. Examination was performed under standardized illumination using a mouth mirror, explorer, and World Health Organization (WHO) Community Periodontal Index (CPI) probe. Three validated indices were recorded:

1. **Simplified Oral Hygiene Index (OHI-S):** Comprising Debris Index-Simplified (DI-S) and Calculus Index-Simplified (CI-S) across six index teeth, scored from 0 to 6 (0.0–1.2 = good, 1.3–3.0 = fair, 3.1–6.0 = poor).
2. **Decayed, Missing, and Filled Teeth (DMFT) Index:** Quantifying cumulative dental caries experience.
3. **Community Periodontal Index (CPI):** Assessing gingival bleeding, calculus, and periodontal pocket depth (Code 0 = healthy; Code 1 = bleeding; Code 2 = calculus; Code 3 = shallow pockets 4–5 mm; Code 4 = deep pockets \ge 6 mm).

Based on composite clinical criteria, patients were categorized into two cohorts:

- **Group A (Good-to-Fair Oral Health):** OHI-S score \le 3.0, maximum CPI code \le 2, and absence of acute odontogenic abscess or active pulpitis.
- **Group B (Poor Oral Health):** OHI-S score > 3.0, and/or generalized periodontitis (CPI code 3 or 4 in \ge 2 sextants), or untreated carious lesions with pulpal involvement.

2.5 Perioperative Care and Outcome Measures

All patients received standardized institutional perioperative care, including weight-adjusted intravenous cefuroxime (1.5 g) administered 30–60 minutes before skin incision, chlorhexidine-alcohol skin preparation, and standard aseptic closure. All participants were instructed to perform routine twice-daily toothbrushing; no invasive dental extractions were performed immediately prior to surgery to avoid delaying scheduled operations.

The primary outcome was the development of a surgical site infection within 30 days postoperatively, diagnosed according to standard Centers for Disease Control and Prevention (CDC) criteria and classified as superficial incisional, deep incisional, or organ/space SSI [13]. Secondary outcomes included postoperative hospital length of stay (LOS, measured in days from surgery to discharge), unexplained postoperative fever (> 38.0 C persisting > 48 hours), postoperative pneumonia, and 30-day hospital readmission. Post-discharge surveillance was conducted via scheduled outpatient surgical clinic visits on postoperative days 7, 14, and 30.

2.6 Ethical Considerations

The study protocol was approved by the Institutional Ethics Committee of Shri Balaji Institute of Medical Sciences, Raipur, Chhattisgarh, India. Written informed consent was obtained from all participants prior to enrollment. Following completion of the 30-day surgical follow-up, patients identified with dental or periodontal disease in Group B were referred to the Department of Dentistry for definitive restorative and periodontal therapy.

2.7 Statistical Analysis

Data were entered into Microsoft Excel and analyzed using IBM SPSS Statistics for Windows, Version 27.0 (IBM Corp., Armonk, NY, USA). Normality of continuous variables was assessed using the Shapiro-Wilk test. Normally distributed data were expressed as mean ±standard deviation (SD) and compared using independent-samples t-tests; skewed data (such as hospital LOS) were reported as median with interquartile range (IQR) and compared using the Mann-Whitney U test. Categorical variables were analyzed using Pearson's chi-square test or Fisher's exact test. Variables demonstrating $p < 0.20$ in univariate analysis were entered into a multivariable binary logistic regression model to identify independent predictors of 30-day SSI. Statistical significance was established at $p < 0.05$.

RESULTS

3.1 Baseline Demographic, Clinical, and Surgical Characteristics

A total of 260 patients completed the 30-day follow-up protocol: 142 (54.6%) in Group A (good-to-fair oral health) and 118 (45.4%) in Group B (poor oral health). The mean age of the study cohort was 46.8 ± 13.4 years, and 56.2% (n = 146) were male. Patients in Group B were significantly older (49.6± 12.9 vs. 44.5 ± 13.4 years; p = 0.002) and had a higher prevalence of tobacco use (44.1% vs. 23.9%; p = 0.001) and type 2 diabetes mellitus (28.0% vs. 16.9%; p = 0.032). Baseline body mass index (BMI), American Society of Anesthesiologists (ASA) physical status, surgical approach (laparoscopic vs. open), and operative duration were comparable between the two cohorts (Table 1).

Table 1: Baseline demographic, clinical, and intraoperative characteristics by preoperative oral health status (N = 260)

Characteristic	Group A: Good-to-Fair Oral Health (n=142)	Group B: Poor Oral Health (n=118)	p-value
Age (years), mean ±SD	44.5 ±13.4	49.6 ±12.9	**0.002**
Male Sex, n (%)	75 (52.8)	71 (60.2)	0.234
BMI (\text{kg/m}^2), mean ±SD	24.8 ±3.9	25.3 ±4.2	0.321
Type 2 Diabetes Mellitus, n (%)	24 (16.9)	33 (28.0)	**0.032**
Current Tobacco Use, n (%)	34 (23.9)	52 (44.1)	**0.001**
ASA Class \ge II, n (%)	54 (38.0)	56 (47.5)	0.125
Open Surgical Approach, n (%)	82 (57.7)	75 (63.6)	0.340
Operative Duration (min), mean ±SD	96.4 ±32.1	101.8 ±34.5	0.193
Preoperative OHI-S Score, mean ±SD	1.62 ±0.68	3.84 ±0.79	< **0.001**
DMFT Score, mean ±SD	3.1 ±2.2	6.8 ±3.1	< **0.001**

3.2 Incidence of Postoperative Complications and Hospital Length of Stay

Overall, 36 patients (13.8%) developed a surgical site infection within 30 days postoperatively, comprising 25 superficial incisional, 8 deep incisional, and 3 organ/space SSIs. The incidence of overall SSI was more than three times higher in Group B compared to Group A (22.0% [n = 26] vs. 7.0% [n = 10]; \chi^2 = 12.14, p < 0.001). Specifically, deep incisional SSIs occurred in 5.1% (n = 6) of Group B patients versus 1.4% (n = 2) of Group A patients.

Furthermore, patients with poor oral health experienced significantly higher rates of postoperative febrile morbidity (18.6% vs. 7.7%; p = 0.009) and postoperative pneumonia (6.8% vs. 1.4%; p = 0.025). Median postoperative length of hospital stay was significantly prolonged by two full days in Group B compared to Group A (7.0 days [IQR: 5–9] vs. 5.0 days [IQR: 4–6]; p < 0.001), accompanied by a higher 30-day readmission rate (10.2% vs. 3.5%; p = 0.030) (Table 2).

Table 2: Comparison of 30-day postoperative clinical outcomes between oral health cohorts (N = 260)

Postoperative Outcome	Group A: Good-to-Fair Oral Health (n=142)	Group B: Poor Oral Health (n=118)	Test Statistic	p-value
Overall Surgical Site Infection, n (%)	10 (7.0)	26 (22.0)	\chi^2 = 12.14	< **0.001**
— Superficial Incisional SSI, n (%)	8 (5.6)	17 (14.4)	\chi^2 = 5.68	**0.017**
— Deep Incisional SSI, n (%)	2 (1.4)	6 (5.1)	Fisher's exact	0.146
— Organ/Space SSI, n (%)	0 (0.0)	3 (2.5)	Fisher's exact	0.092
Postoperative Fever (> 38.0^\circ\text{C}), n (%)	11 (7.7)	22 (18.6)	\chi^2 = 6.91	**0.009**
Postoperative Pneumonia, n (%)	2 (1.4)	8 (6.8)	Fisher's exact	**0.025**
Hospital Length of Stay (days), median (IQR)	5.0 (4.0–6.0)	7.0 (5.0–9.0)	U = 5142.0	< **0.001**
30-Day Unplanned Readmission, n (%)	5 (3.5)	12 (10.2)	\chi^2 = 4.69	**0.030**

3.3 Multivariable Predictors of Surgical Site Infection

In multivariable binary logistic regression adjusting for age, diabetes mellitus, tobacco use, ASA class, surgical approach, and operative duration (Table 3), poor preoperative oral health remained the strongest independent predictor of postoperative SSI (AOR = 3.24, 95% CI: 1.46–7.18; p = 0.004). Type 2 diabetes mellitus (AOR = 2.48, 95% CI: 1.12–5.49; p = 0.025) and open surgical approach compared to laparoscopy (AOR = 2.31, 95% CI: 1.01–5.28; p = 0.047) were also independently associated with higher odds of SSI.

Table 3: Univariate and multivariable logistic regression analysis of risk factors for 30-day surgical site infection (N = 260)

Variable	Univariate OR (95% CI)	p-value	Adjusted OR (95% CI)	p-value
Poor Preoperative Oral Health (Group B)	3.73 (1.72–8.09)	**0.001**	3.24 (1.46–7.18)	**0.004**
Age > 50 years	1.86 (0.91–3.80)	0.089	1.38 (0.64–2.98)	0.412
Type 2 Diabetes Mellitus	2.94 (1.39–6.21)	**0.005**	2.48 (1.12–5.49)	**0.025**
Current Tobacco Use	2.15 (1.05–4.41)	**0.036**	1.54 (0.71–3.34)	0.274
ASA Class \ge II	1.92 (0.94–3.92)	0.073	1.42 (0.66–3.05)	0.369
Open Surgical Approach (vs. Laparoscopic)	2.52 (1.13–5.62)	**0.024**	2.31 (1.01–5.28)	**0.047**
Operative Duration > 120 minutes	2.08 (0.98–4.41)	0.056	1.79 (0.81–3.96)	0.150

DISCUSSION

This prospective interdisciplinary cohort study demonstrates a strong, independent association between compromised preoperative oral health and adverse postoperative outcomes among patients undergoing elective abdominal surgery. Patients presenting with poor oral hygiene and moderate-to-severe periodontitis experienced more than a threefold higher incidence of 30-day surgical site infections (22.0% vs. 7.0%) and required a median of two additional days of inpatient hospitalization compared to patients with healthy oral tissues. Crucially, even after controlling for established surgical confounders such as diabetes mellitus, tobacco consumption, and open surgical access, poor oral health conferred a 3.24-fold increase in the adjusted odds of developing an SSI.

Our findings corroborate and extend emerging surgical literature linking oral microbial reservoirs to distant postoperative infections. Previous investigations in gastrointestinal oncology, esophageal resection, and colorectal surgery have similarly reported that preoperative periodontal disease significantly elevates postoperative infectious morbidity and anastomotic complications [12, 14, 15]. Three interrelated pathophysiological mechanisms explain this clinical relationship. First, severe periodontitis creates an ulcerated periodontal pocket epithelium surface area estimated at 15–20\text{ cm}^2, enabling translocation of oral anaerobes and facultative pathogens—such as Porphyromonas gingivalis, Fusobacterium nucleatum, and Streptococcus species—into the bloodstream during perioperative manipulation and endotracheal intubation [6, 7]. Second, chronic oral infection sustains a low-grade systemic hyperinflammatory state characterized by elevated pro-inflammatory cytokines and endothelial dysfunction, which blunts effective local immune cell recruitment and impairs collagen synthesis at distant abdominal surgical incisions [9, 10]. Third, heavy oral biofilm accumulation acts as a reservoir for respiratory colonization, accounting for the significantly higher incidence of postoperative pneumonia observed in Group B (6.8% vs. 1.4%) [8].

From a clinical and public health perspective in central India, these findings carry immediate translational value. In our cohort, nearly half (45.4%) of adult patients presenting for elective general surgery had significant untreated oral pathology, driven partly by high rates of smokeless tobacco and betel quid use in Chhattisgarh [11]. Unlike non-modifiable risk factors such as age or surgical complexity, oral bacterial load can be rapidly reduced prior to elective surgery. Simple, inexpensive preoperative interventions—such as professional supragingival scaling, extraction of non-restorable septic teeth at least 7–10 days before surgery, and short-term perioperative 0.12% chlorhexidine gluconate mouthrinses—have been shown to substantially reduce bacteremia and postoperative infectious complications [15, 16].

Strengths and Limitations

Key strengths of this study include its prospective cohort design, blinded standardized dental examination using validated WHO and epidemiological indices, standardized perioperative antibiotic prophylaxis, and complete 30-day CDC-defined surgical surveillance. However, certain limitations should be acknowledged. Microbiological cultures of wound exudates were not systematically matched against subgingival plaque samples to confirm clonal bacterial identity, and single-center recruitment may limit generalizability across diverse healthcare tiers. Future randomized controlled trials are warranted to quantify the exact magnitude of SSI reduction achievable through standardized preoperative dental prehabilitation bundles.

CONCLUSION

Poor preoperative oral health is a prevalent, yet frequently overlooked, independent predictor of surgical site infections, postoperative pneumonia, and prolonged hospital stay in patients undergoing elective abdominal surgery. Bridging the clinical divide between general surgery and dentistry offers a practical avenue to enhance patient safety. We recommend:

1. Routine Preoperative Oral Screening: Incorporating a brief, standardized oral health checklist into preoperative surgical anesthesia clinics to flag patients with gross calculus, mobile teeth, or periodontal suppuration.
2. Interdisciplinary Prehabilitation Referrals: Establishing streamlined fast-track referrals from general surgery outpatient clinics to institutional dental departments for basic oral prophylaxis and septic focus elimination prior to elective surgery.
3. Perioperative Oral Antisepsis: Implementing supervised preoperative and early postoperative 0.12% chlorhexidine oral rinses as a low-cost adjunct within standard enhanced recovery after surgery (ERAS) protocols.

Declarations

- Authors' Contributions: GSC and VGC jointly conceptualized the study design. GSC supervised surgical patient recruitment, intraoperative data collection, and 30-day SSI surveillance. VGC performed calibrated preoperative dental evaluations, coordinated data management, and drafted the manuscript. Both authors performed statistical interpretation and approved the final manuscript.
- Ethics Approval and Consent to Participate: Approved by the Institutional Ethics Committee of Shri Balaji Institute of Medical Sciences, Raipur, Chhattisgarh, India. Written informed consent was obtained from all participants.
- Funding: None.
- Conflict of Interest: The authors declare no conflicts of interest.

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