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A COMPARATIVE OBSERVATIONAL STUDY TO ASSESS SURGICAL SITE INFECTION RATES USING ASA GRADING AND CHARLSON COMORBIDITY INDEX

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ABSTRACT

Background: Surgical site infections (SSIs) remain a major cause of postoperative morbidity, prolonged hospitalization, and increased healthcare costs. Preoperative risk stratification using the American Society of Anesthesiologists (ASA) grading and Charlson Comorbidity Index (CCI) may help identify patients at higher risk of SSI. **Objectives:** To compare the frequency of SSIs using ASA grading and Charlson Comorbidity Index among clean, clean-contaminated, and contaminated surgeries.**Methods:** This observational comparative study was conducted at tertiary care hospital over a period of 24 months.148 patients undergoing clean, clean-contaminated, and contaminated surgical procedures were included for the study. Patients were categorized according to ASA physical status and CCI scores. SSI incidence was compared across these categories using appropriate statistical analysis.**Results:** SSI frequency was higher among patients with elevated ASA grades and higher CCI scores. Infection rates increased progressively from clean to contaminated wounds. Both ASA grading and CCI demonstrated significant association with SSI occurrence, with varying predictive value across wound classes. **Conclusion:** ASA grading and CCI are valuable tools for predicting postoperative SSI risk. Combined use of both indices may improve perioperative risk stratification and assist in identifying high-risk patients for targeted preventive measures.

KEYWORDS

Surgical Site Infection, Asa Grading, Charlson Comorbidity Index, Risk Stratification, Postoperative Complications

INTRODUCTION

Surgical site infections (SSIs) constitute a major proportion of postoperative complications globally and continue to be an important benchmark of quality and safety in surgical practice. [1] The development of SSIs is influenced by complex interactions between patient factors, microbial load, surgical wound characteristics, and perioperative care. [2] They are associated with extended length of hospital stay, higher economic burden, reduced patient satisfaction, and increased postoperative morbidity. Surgical wound classification is categorized into clean, clean-contaminated, contaminated, and dirty wounds provides a foundational framework to estimate SSI risk. [3] However, wound classification alone does not adequately predict SSI risk, as outcomes vary considerably within the same wound category. This underscores the importance of incorporating clinical risk stratification tools that assess patient physiology and comorbidity burden alongside wound classification during preoperative evaluation. The American Society of Anesthesiologists (ASA) Physical Status classification is one of the most widely used preoperative risk assessment systems. [4] It categorizes patients based on overall physiological health, ranging from ASA I (healthy) to ASA V (moribund). Higher ASA grades reflect increased systemic compromise and reduced physiological reserve, which correlate with poorer postoperative outcomes. Several studies suggest that higher ASA grades are associated with delayed wound healing and impaired immune responses, both of which promote susceptibility to SSIs.

In contrast, the Charlson Comorbidity Index (CCI) is a validated scoring system designed to predict long-term mortality by quantifying the burden of chronic illnesses. [5] The index assigns weighted scores to comorbid conditions such as diabetes, cardiac disease, renal impairment, malignancy, liver dysfunction, and connective tissue disorders. CCI is an objective tool and has been increasingly used in perioperative settings to evaluate postoperative complications; however, its direct comparative value in predicting SSIs across different surgical wound classes remains insufficiently studied.

Both ASA grading and CCI provide complementary insights into patient-related risks. [6] ASA reflects current physiological stability, operative fitness, and anesthetic risk, while CCI reflects chronic disease burden and long-term systemic vulnerability. Determining whether physiological assessment (ASA) or comorbidity-based assessment (CCI) is more useful in predicting SSIs remains a critical gap in surgical risk evaluation.

Variability in comorbidity profiles, surgical practices, and infection control protocols across institutions highlights the need for local data to guide clinical decision-making. [7] Local epidemiological patterns of SSI can differ significantly, influenced by patient population characteristics, surgical volume, antibiotic resistance patterns, and perioperative practices. Comparative assessments of ASA grading and CCI within a local hospital setting can provide practical, context-specific insights that help improve surgical outcomes. [8]

Given these considerations, the present observational comparative study aims to estimate and compare the frequencies of surgical site infections using ASA grading and Charlson Comorbidity Index in clean, clean-contaminated, and contaminated surgeries.

Materials and Methods

The observational comparative study was conducted in two institutional settings: Sri Siddhartha Medical College & Hospital, Tumkur, and the District Hospital, Tumkur, over a period of 24 months. Using a purposive sampling technique, 148 participants fulfilling the inclusion criteria were selected for the study. Ethical clearance was obtained from the Institutional Ethics Committee before starting the study.

Inclusion Criteria

Patients aged above 18 years undergoing surgical procedures involving skin incisions, willing to attend 30-day postoperative follow-up for SSI assessment, surgical cases falling under clean, clean-contaminated, or contaminated wound categories, having ASA grade I–IV and CCI score 0–6 reliably determined preoperatively, willing to provide written informed consent for participation.

Exclusion Criteria

Patients with ASA grade V or above, dirty wounds, undergoing procedures not involving incisions, such as endoscopic or minimally invasive non-incisional interventions, with incomplete data preventing accurate CCI or ASA scoring, refusing to provide written informed consent.

Detailed demographic, clinical, and surgical information was recorded in a predesigned data collection sheet. Preoperative assessment included assigning ASA grade and calculating the Charlson Comorbidity Index based on documented comorbidities. The surgical team classified each patient's wound category intraoperatively as clean, clean-contaminated, or contaminated based on operative findings. Throughout hospitalization, the postoperative wound was examined daily, and ASEPSIS score components were documented meticulously. Patients received standard postoperative care as per institutional protocols, and no modifications to treatment were introduced for study purposes. Upon discharge, patients were instructed to return for follow-up or communicate if any wound-related concerns developed. A 30-day postoperative follow-up period was maintained for each participant to detect delayed or superficial wound infections. Pus samples were collected from suspected infections and sent for culture and sensitivity testing.

Data was collected using a pre-designed structured proforma and entered into Microsoft Excel. Statistical analysis was performed using SPSS version 27.0. Descriptive statistics were used to summarize numerical variables (mean, standard deviation) and categorical variables (frequency, percentage). Chi-square test was applied to determine associations between categorical variables, particularly the relationship between ASA grades, CCI categories, wound class, and SSI occurrence. P-values less than 0.05 were interpreted as statistically significant.

RESULT

Table 1: Baseline Sociodemographic Characteristics of Study Participants (N = 148)

Variable	Category	Frequency (n)	Percentage (%)
Age Category (years)	18–30	33	22.3
	31–40	29	19.6
	41–50	36	24.3
	51–60	25	16.9
	61–70	25	16.9
Sex	Male	81	54.7
	Female	67	45.3
Occupation	Clerk	36	24.3
	Farmer	31	20.9
	Homemaker	34	23.0
	Teacher	23	15.5
	Worker	24	16.2
Religion	Hindu	116	78.4
	Muslim	17	11.5
	Christian	8	5.4

The study population comprised participants across a broad age range, with the highest proportion belonging to the 41–50 year's age group (24.3%), followed by 18–30 years (22.3%). Males constituted a slightly higher proportion of the cohort (54.7%) compared to females (45.3%). Regarding occupation, clerks (24.3%) and homemakers (23.0%) formed the major groups, followed by farmers (20.9%). Most participants were Hindus (78.4%), while Muslims and Christians constituted smaller proportions of the study population. This distribution reflects a diverse sociodemographic profile with adequate representation across age, sex, occupational, and religious categories.

Table 2: Surgical and Clinical Characteristics of Study Participants (N = 148)

Variable	Category	Frequency (n)	Percentage (%)
Type of Procedure	Elective	107	72.3
	Emergency	41	27.7
Preoperative Diagnosis	Appendicitis	33	22.3
	Cholelithiasis	31	20.9
	Hernia	27	18.2
	Hydrocele	28	18.9
	Thyroid swelling	29	19.6
Type of Surgery	Laparoscopic	49	33.1
	Open	99	66.9
Wound Class	Clean	71	48.0
	Clean-contaminated	51	34.5
	Contaminated	26	17.6

The majority of study participants underwent elective surgical procedures (72.3%), while emergency surgeries accounted for 27.7% of cases. Appendicitis (22.3%) was the most common preoperative diagnosis, followed closely by cholelithiasis (20.9%) and thyroid swelling (19.6%), with hernia and hydrocele contributing comparable proportions. Open surgical procedures were more commonly performed (66.9%) than laparoscopic surgeries (33.1%). Regarding wound classification, nearly half of the surgical wounds were categorized as clean (48.0%), followed by clean-contaminated (34.5%) and contaminated wounds (17.6%). Overall, the findings demonstrate a balanced distribution of common surgical conditions and operative characteristics within the study population.

Table 3: Distribution of Study population by ASA Class (N = 148)

ASA Class	Frequency	Percentage (%)
I	51	34.5
II	78	52.7
III	15	10.1
IV	4	2.7
Total	148	100

The majority of patients belonged to ASA Class II (52.7%), followed by Class I (34.5%). Higher-risk categories were less common, with 10.1% in Class III and only 2.7% in Class IV. This indicates that most participants were in low-to-moderate preoperative risk groups.

Table 4: Distribution of Charlson Comorbidity Index (CCI) Scores Among Study Participants (N = 148)

Variable	Category	Frequency (n)	Percentage (%)
CCI Age Points	0	62	41.9
	1	36	24.3
	2	25	16.9
	3	25	16.9
CCI Comorbidity Points	0	74	50.0
	1	27	18.2
	2	30	20.3
	3	11	7.4
	4	6	4.1
Total CCI Score	0	29	19.6
	1	32	21.6
	2	35	23.6
	3	24	16.2
	4	13	8.8
	5	11	7.4
	6	4	2.7

Majority of participants had 0 CCI age points (41.9%), indicating that most were below the age threshold contributing to comorbidity scoring, while the remaining categories were distributed evenly. Regarding CCI age points, 41.9% of participants had a score of 0, while the remaining participants were relatively evenly distributed across higher age-point categories.

For CCI comorbidity points, half of the participants scored 0 points (50.0%), while scores of 1 and 2 points accounted for 18.2% and 20.3% respectively. Higher scores were less frequent, with 7.4% scoring 3 points and only 4.1% scoring 4 points. This shows that most participants fell within the lower point categories.

Scores were distributed across all categories, with the highest proportion in score 2 (23.6%) and score 1 (21.6%). Score 0 accounted for 19.6%, while higher scores were progressively less common: 16.2% scored 3, 8.8% scored 4, 7.4% scored 5, and only 2.7% reached score 6. This pattern reflects a gradual decline in frequency as the score increases.

Table 5: Distribution of study population by Comorbidity Profile

Comorbidity	Yes (n, %)	No (n, %)
Diabetes	36 (24.3%)	112 (75.7%)
Hypertension	44 (29.7%)	104 (70.3%)
COPD/Asthma	19 (12.8%)	129 (87.2%)
Renal Disease	9 (6.1%)	139 (93.9%)

Hypertension (29.7%) and diabetes (24.3%) were the most common comorbidities among participants. Respiratory conditions such as COPD/asthma were present in 12.8%, while renal disease was least frequent (6.1%). Across all conditions, the majority of participants reported no comorbidities.

Table 6: Distribution of Surgical Site Infection (SSI) Status (N = 148)

SSI Status	Frequency	Percentage

Yes	37	25.0%
No	111	75.0%
Total	148	100.0%

Surgical site infection was observed in one-quarter of the study population (25.0%), while the majority of patients (75.0%) did not develop SSI. This finding indicates a considerable burden of postoperative wound infection within the cohort, underscoring the clinical importance of perioperative infection control measures and vigilant postoperative surveillance to reduce SSI-related morbidity.

Table 7: Distribution of Surgical Site Infection Severity and ASEPSIS Wound Assessment Categories (N = 148)

Variable	Category	Frequency (n)	Percentage (%)
SSI Type	No SSI	113	76.4
	Superficial	20	13.5
	Deep	14	9.5
	Organ/Space	1	0.7
ASEPSIS Category	No infection	119	80.4
	Minor	11	7.4
	Moderate	12	8.1
	Severe	6	4.1

The distribution of postoperative wound infection demonstrated that the majority of study participants remained free from infection according to both standard SSI classification and ASEPSIS wound assessment criteria. Overall, 113 patients (76.4%) had no evidence of SSI, while 119 patients (80.4%) were categorized as having no infection on ASEPSIS assessment. Among patients who developed SSI, superficial incisional infections were the most common, occurring in 20 patients (13.5%), followed by deep incisional infections in 14 patients (9.5%). Organ/space infections were rare and observed in only 1 patient (0.7%). Similarly, ASEPSIS wound assessment revealed that minor infections were present in 11 patients (7.4%), moderate infections in 12 patients (8.1%), and severe infections in 6 patients (4.1%). These findings indicate that although postoperative wound infections occurred in a subset of participants, the majority were limited to superficial or moderate severity, with relatively few progressing to severe or organ/space involvement, thereby reflecting a moderate overall burden of postoperative infectious morbidity in the study cohort.

Table 8: Association of Patient and Surgical Variables with Surgical Site Infection (SSI) (N = 148)

Variable	Category	SSI Absent n (%)	SSI Present n (%)	χ^2	df	p-value
Age Category (years)	18–30	28 (84.8)	5 (15.2)	4.464	4	0.347
	31–40	19 (65.5)	10 (34.5)			
	41–50	29 (80.6)	7 (19.4)			
	51–60	18 (72.0)	7 (28.0)			
	61–70	17 (68.0)	8 (32.0)			
Sex	Female	51 (76.1)	16 (23.9)	0.082	1	0.775
	Male	60 (74.1)	21 (25.9)			
Type of Surgery	Laparoscopic	36 (73.5)	13 (26.5)	1.002	2	0.606
	Open	67 (74.4)	23 (25.6)			
	Open Jaboulay's	8 (88.9)	1 (11.1)			
Wound Class	Clean	52 (73.2)	19 (26.8)	2.870	2	0.238
	Clean-contaminated	42 (82.4)	9 (17.6)			
	Contaminated	17 (65.4)	9 (34.6)			
ASA Physical Status	ASA I	38 (74.5)	13 (25.5)	1.913	3	0.591
	ASA II	59 (75.6)	19 (24.4)			
	ASA III	10 (66.7)	5 (33.3)			
	ASA IV	4 (100.0)	0 (0.0)			
CCI Group	CCI 0	23 (79.3)	6 (20.7)	0.357	1	0.550
	CCI 1–6	88 (73.9)	31 (26.1)			

The association analysis demonstrated variable rates of surgical site infection across demographic, surgical, and clinical parameters; however, none of the studied variables showed a statistically significant association with SSI occurrence ($p > 0.05$). SSI rates were relatively higher among participants aged 31–40 years (34.5%) and 61–70 years (32.0%) compared to other age groups, although age category was not significantly associated with SSI ($\chi^2 = 4.464$, $p = 0.347$). Similarly, the incidence of SSI was comparable between males (25.9%) and females (23.9%) without significant sex-based differences ($\chi^2 = 0.082$, $p = 0.775$).

Regarding operative characteristics, contaminated wounds demonstrated the highest SSI rate (34.6%), followed by clean wounds (26.8%) and clean-contaminated wounds (17.6%); however, this trend did not achieve statistical significance ($\chi^2 = 2.870$, $p = 0.238$). SSI rates were also comparable across laparoscopic, open, and Open Jaboulay's procedures ($\chi^2 = 1.002$, $p = 0.606$). Patients classified as ASA III exhibited a relatively higher SSI rate (33.3%) compared to ASA I and II groups, whereas no SSI was observed among ASA IV patients, likely due to the limited sample size. Nevertheless, ASA physical status did not significantly influence SSI occurrence ($\chi^2 = 1.913$, $p = 0.591$). Likewise, participants with higher comorbidity burden (CCI 1–6) showed a marginally increased SSI rate (26.1%) compared to those with CCI 0 (20.7%), but this association was not statistically significant ($\chi^2 = 0.357$, $p = 0.550$). Overall, these findings suggest that no single demographic, operative, or comorbidity-related variable independently predicted surgical site infection within the present study cohort.

Table 9: Association of Charlson Comorbidity Index (CCI) Group with Demographic, Surgical, and Clinical Variables (N = 148)

Variable	Category	CCI 0 n (%)	CCI 1–6 n (%)	χ^2	df	p-value
Sex	Female	12 (17.9)	55 (82.1)	0.220	1	0.639
	Male	17 (21.0)	64 (79.0)			
Type of Surgery	Laparoscopic	6 (12.2)	43 (87.8)	3.435	2	0.180
	Open	22 (24.4)	68 (75.6)			
	Open Jaboulay's	1 (11.1)	8 (88.9)			
Wound Class	Clean	16 (22.5)	55 (77.5)	0.805	2	0.669
	Clean-contaminated	9 (17.6)	42 (82.4)			
	Contaminated	4 (15.4)	22 (84.6)			
ASA Class	ASA I	12 (23.5)	39 (76.5)	5.371	3	0.147
	ASA II	17 (21.8)	61 (78.2)			
	ASA III	0 (0.0)	15 (100.0)			
	ASA IV	0 (0.0)	4 (100.0)			
Wound Class and ASA Status	Clean	ASA I: 23 (32.4)	ASA II: 39 (54.9)	2.598	6	0.857
		ASA III: 7 (9.9)	ASA IV: 2 (2.8)			
	Clean-contaminated	ASA I: 21 (41.2)	ASA II: 25 (49.0)			
		ASA III: 4 (7.8)	ASA IV: 1 (2.0)			
	Contaminated	ASA I: 7 (26.9)	ASA II: 14 (53.8)			
		ASA III: 4 (15.4)	ASA IV: 1 (3.8)			

The majority of study participants across all demographic and clinical categories belonged to the higher comorbidity group (CCI 1–6), indicating a substantial burden of comorbid illness within the cohort. No statistically significant association was observed between sex and CCI group distribution ($\chi^2 = 0.220$, $p = 0.639$), although males demonstrated a slightly higher proportion of patients with CCI 0 (21.0%) compared to females (17.9%).

With respect to surgical approach, patients undergoing laparoscopic procedures (87.8%) and Open Jaboulay's procedures (88.9%) more frequently belonged to the higher CCI group compared to those undergoing open surgery (75.6%); however, the association between type of surgery and CCI group was not statistically significant (χ^2 = 3.435, p = 0.180). Similarly, increasing wound contamination demonstrated a gradual rise in the proportion of patients within the higher comorbidity category, ranging from 77.5% in clean wounds to 84.6% in contaminated wounds, although this trend was not statistically significant (χ^2 = 0.805, p = 0.669).

Analysis of ASA physical status showed that all patients classified as ASA III and ASA IV belonged to the higher CCI group (100.0%), whereas lower ASA categories included a small proportion of patients with CCI 0. Despite this apparent trend toward increasing comorbidity burden with worsening ASA class, the association did not achieve statistical significance (χ^2 = 5.371, p = 0.147). Furthermore, no significant association was identified between wound class and ASA physical status (χ^2 = 2.598, p = 0.857), although contaminated wounds demonstrated relatively higher proportions of ASA III patients. Collectively, these findings suggest that demographic characteristics, surgical variables, wound classification, and ASA status were not independently associated with Charlson Comorbidity Index grouping in the present study population.

Table 10: Association Between ASEPSIS Category and Surgical Site Infection (SSI) Status (N = 148)

ASEPSIS Category	SSI Absent n (%)	SSI Present n (%)	Total n (%)
No infection	111 (93.3%)	8 (6.7%)	119 (100.0%)
Minor	0 (0.0%)	11 (100.0%)	11 (100.0%)
Moderate	0 (0.0%)	12 (100.0%)	12 (100.0%)
Severe	0 (0.0%)	6 (100.0%)	6 (100.0%)
Total	111 (75.0%)	37 (25.0%)	148 (100.0%)
χ^2 = 108.202, df = 3, p < 0.001			

A very strong association was observed between ASEPSIS category and the presence of surgical site infection. All patients classified as having minor, moderate, or severe ASEPSIS scores had confirmed SSI (100.0%), whereas the majority of patients categorized as having no infection did not develop SSI (93.3%). Chi-square analysis demonstrated a highly statistically significant association between ASEPSIS category and SSI occurrence (χ^2 = 108.202, df = 3, p < 0.001). This finding validates the ASEPSIS scoring system as a robust indicator of postoperative wound infection severity and its direct correlation with SSI in the present study cohort.

Table 11: Comparison of Length of Hospital Stay Between SSI Groups (N = 148)

SSI Status	N	Mean ± SD (days)
Yes	37	6.54 ± 1.74
No	111	3.95 ± 0.82
Total	148	—
t = 12.134, df = 146, p < 0.001		

Patients who developed surgical site infection had a significantly longer hospital stay compared to those without SSI. The mean length of stay was 6.54 ± 1.74 days in the SSI group versus 3.95 ± 0.82 days in the non-SSI group. Independent samples t-test demonstrated a highly statistically significant difference between the two groups (t = 12.134, df = 146, p < 0.001). This finding indicates that SSI is associated with a substantial prolongation of hospitalization, reflecting increased postoperative morbidity and resource utilization in affected patients.

Table 12: Comparison of ASEPSIS Total Score and CCI Total Score by SSI Status (N = 148)

SSI Status	N	ASEPSIS Total Score (Mean ± SD)	CCI Total Score (Mean ± SD)
Yes	37	26.65 ± 13.47	2.65 ± 1.74
No	111	4.23 ± 2.90	1.86 ± 1.54
Statistics	—	t = 16.534, df = 146, p < 0.001	t = 2.596, df = 146, p = 0.010

Patients with surgical site infection had significantly higher ASEPSIS total scores compared to those without SSI, indicating markedly greater wound infection severity (p < 0.001). Additionally, the Charlson Comorbidity Index score was significantly higher in the SSI group (p = 0.010), demonstrating that increased comorbidity burden is associated with a higher risk of SSI. These findings emphasize the combined impact of local wound factors and systemic comorbidities on postoperative infectious outcomes.

Table 13: Comparison of ASEPSIS Total Score and CCI Total Score by ICU Admission Status (N = 148)

ICU Admission Status	N	ASEPSIS Total Score (Mean ± SD)	CCI Total Score (Mean ± SD)
Yes	26	9.88 ± 12.37	2.92 ± 1.74
No	122	9.82 ± 12.05	1.88 ± 1.54
Statistics	—	t = 0.025, df = 146, p = 0.980	t = 3.071, df = 146, p = 0.003

There was no statistically significant difference in ASEPSIS total scores between patients who required ICU admission and those who did not (p = 0.980), indicating that wound infection severity alone did not influence ICU requirement in this cohort.

In contrast, the Charlson Comorbidity Index score was significantly higher among patients requiring ICU admission compared to those managed outside the ICU (2.92 ± 1.74 vs. 1.88 ± 1.54; p = 0.003). This finding suggests that a higher systemic comorbidity burden is an important determinant of ICU admission, independent of local wound infection severity.

DISCUSSION

The primary aim of this observational comparative study was to assess the rate of surgical site infection among patients undergoing common surgical procedures and to evaluate its association with preoperative risk stratification tools, specifically the American Society of Anesthesiologists (ASA) physical status grading and the Charlson Comorbidity Index (CCI).

The present study included 148 participants with a mean age of 43.72 ± 14.8 years, representing a predominantly middle-aged surgical population. The highest proportion of participants belonged to the 41–50-year age group, followed by the 18–30-year and 31–40-year groups. Males constituted a slightly higher proportion of the cohort than females. This demographic distribution is comparable with findings reported by Whitmore et al. [9], who observed that increasing age was associated with higher perioperative risk and comorbidity burden. Varady et al. [10] similarly demonstrated that age alone had limited predictive value for postoperative complications unless combined with comorbidity indices. The slight male predominance observed in the present study is consistent with previous surgical cohorts described by Strombom et al. [11]. Overall, the sociodemographic profile reflects a representative adult surgical population suitable for evaluating SSI risk in relation to ASA grading and comorbidity burden.

Elective surgeries accounted for the majority of procedures in the present study, while emergency surgeries constituted approximately one-fourth of cases. Open surgical procedures were more commonly performed than laparoscopic surgeries. Clean wounds represented the largest wound category, followed by clean-contaminated and contaminated wounds. Similar distributions have been reported by Tefera et al. [12], who noted that wound contamination and emergency procedures contributed to increased postoperative infectious risk. The relatively balanced distribution of diagnoses and wound classes in the present study supports the applicability of the findings across a broad surgical population.

Most participants in the present study belonged to ASA Class II, followed by ASA I, whereas fewer patients were categorized as ASA III and ASA IV. This distribution indicates that the majority of patients had mild-to-moderate systemic disease. Guo et al. [13] reported increased morbidity among patients with ASA ≥ III. However, the predominance of lower ASA grades in the present study may partly explain the relatively favorable postoperative outcomes and low mortality observed within the cohort.

Assessment of comorbidity burden revealed that lower CCI scores predominated in the study population, with progressively fewer participants demonstrating higher scores. Total CCI score 2 was the most frequent category. Similar findings were reported by Dessai et al. [14], who observed that moderate CCI scores were common among general surgical patients, while higher scores were associated with increased postoperative adverse events. The predominance of lower-to-moderate CCI scores in the present study reflects a relatively stable surgical population with limited severe systemic disease burden.

Hypertension and diabetes mellitus were the most common comorbidities identified in the present study, while renal disease was comparatively infrequent. This pattern is comparable to findings by Ulyett et al. [15], who demonstrated that cardiovascular and metabolic disorders constituted the predominant comorbid conditions associated with postoperative morbidity. The relatively lower prevalence of severe chronic illnesses in the present cohort may have contributed to the overall low mortality rate.

Surgical site infection was observed in one-fourth of the study population, indicating a moderate postoperative infection burden. This incidence is comparable to the SSI rates reported by Strombom et al. [11] in major abdominal surgeries. Tefera et al. [12] also demonstrated that SSI incidence is influenced by perioperative infection prevention practices and patient comorbidity burden. The present findings emphasize that SSI continues to represent a clinically important postoperative complication despite advances in perioperative care and infection control measures.

Most participants in the present study did not develop postoperative wound infection according to both SSI classification and ASEPSIS assessment. Among infected cases, superficial SSI was the most common subtype, while severe and organ-space infections were relatively uncommon. Similar observations were made by Whitmore et al. [9], who noted that most postoperative infections are confined to superficial or moderate severity categories. Strombom et al. [80] further emphasized the value of objective wound assessment systems in identifying clinically meaningful postoperative infectious morbidity. The low frequency of severe infection in the present study may reflect effective postoperative wound surveillance and standardized infection prevention practices.

Although SSI rates varied across age groups, wound classes, ASA categories, and surgical approaches, none of these variables demonstrated a statistically significant association with SSI occurrence. Contaminated wounds and ASA III patients showed relatively higher SSI rates; however, these trends did not reach statistical significance. Similar findings were reported by Strombom et al. [11] and Guo et al. [13] who observed that individual demographic and operative variables alone had limited predictive value for postoperative infection when perioperative care was standardized. Tefera et al. [12], however, demonstrated significant associations between higher ASA grade and SSI in settings with higher baseline infection rates. The present findings suggest that SSI risk is multifactorial and influenced by combined patient, operative, and perioperative management factors rather than any single variable independently.

The majority of participants across all demographic and surgical categories belonged to the higher CCI group (CCI 1–6). Although higher ASA classes demonstrated greater comorbidity burden, the association between ASA class and CCI group did not achieve statistical significance. Whitmore et al. [9] similarly reported overlap between ASA grading and CCI in predicting postoperative risk. The absence of statistically significant associations in the present study may reflect the relatively limited number of patients with severe systemic disease.

A highly significant association was observed between ASEPSIS category and SSI occurrence in the present study. All patients categorized as having minor, moderate, or severe ASEPSIS scores had confirmed SSI, validating ASEPSIS as a robust postoperative wound assessment tool. Strombom et al. [11] emphasized that direct wound assessment systems often provide superior evaluation of localized postoperative complications compared to generalized comorbidity indices. These findings confirm the reliability of ASEPSIS scoring for postoperative SSI surveillance and severity assessment.

Patients who developed SSI had significantly prolonged hospital stay compared to those without SSI. This finding is consistent with observations by Whitmore et al. [9], who reported increased healthcare utilization and postoperative costs among patients with postoperative complications. The present findings underscore the clinical and economic burden associated with postoperative wound infection.

Patients with SSI demonstrated significantly higher ASEPSIS total scores and higher mean CCI scores compared to those without SSI. These findings indicate that greater comorbidity burden is associated with increased postoperative infection severity. Similar observations were reported by Dessai et al. [14] and Ulyett et al. [15], who demonstrated that increasing CCI scores correlate with higher postoperative morbidity and adverse clinical outcomes. The present study supports the role of both ASEPSIS scoring and CCI assessment as valuable tools for evaluating postoperative infectious morbidity and overall surgical risk.

The present study possesses several important strengths, including the use of validated assessment tools such as ASA grading, Charlson Comorbidity Index, and ASEPSIS wound scoring for comprehensive evaluation of postoperative outcomes. Inclusion of a well-characterized cohort with diverse demographic and surgical profiles enhanced the reliability and clinical applicability of the findings. Standardized postoperative surveillance and objective SSI assessment improved diagnostic accuracy and consistency. The study also evaluated clinically relevant outcomes including ICU admission, length of hospital stay, and short-term mortality, thereby strengthening its practical significance. However, the single-center observational design and relatively small sample size in higher ASA and CCI categories may limit generalizability and statistical power. In addition, potential confounding variables such as operative duration, nutritional status, and intraoperative factors were not evaluated, and long-term postoperative outcomes beyond 30 days were not assessed.

CONCLUSION

From the above results it can be concluded that surgical site infection is a multifactorial outcome influenced by an interplay of patient comorbidities, physiological status, and postoperative wound characteristics rather than isolated demographic or procedural factors. While ASA grading provides a useful overview of preoperative physiological risk, and CCI reflects systemic disease burden, neither index alone is sufficient to predict SSI occurrence. However, when combined with objective wound assessment and postoperative monitoring, these tools offer valuable insight into patient risk stratification and outcome prediction.

The findings highlight the need for integrated perioperative risk assessment strategies that incorporate comorbidity evaluation and structured wound surveillance to reduce postoperative morbidity, optimize hospital resource utilization, and improve overall surgical outcomes.

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