



Correlation Between ASA Physical Status, Comorbidity Burden and Postoperative Outcomes in Patients Undergoing Elective Surgery: A Cross-Sectional Study

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ABSTRACT

Background: Preoperative risk stratification underpins safe perioperative care. The American Society of Anesthesiologists (ASA) physical status classification and comorbidity indices such as the Charlson Comorbidity Index (CCI) are widely used, yet comparative data on their predictive value for short-term surgical morbidity in South Indian elective surgical populations remain limited. **Objective:** To examine the correlation between ASA physical status, comorbidity burden (simple comorbidity count and CCI) and postoperative outcomes in adults undergoing elective surgery. **Methods:** This cross-sectional study enrolled 250 adults undergoing elective surgery at a tertiary care teaching hospital in South India. ASA grade, comorbidity count and CCI were recorded preoperatively. Outcomes were postoperative complications, intensive care unit (ICU) admission and hospital length of stay. Associations were assessed using chi-square tests, unpaired t-tests, Pearson correlation and receiver operating characteristic (ROC) analysis; $p < 0.05$ was significant. **Results:** Mean age was 53.2 (SD 19.7) years; 133 (53.2%) were female. Postoperative complications occurred in 70 patients (28.0%, 95% CI 22.4–33.6%) and ICU admission in 22 (8.8%). Complication rate rose stepwise across ASA grades (I 10.3%, II 19.0%, III 35.4%, IV 45.3%; $\chi^2=22.75$, $p < 0.001$), as did ICU admission ($\chi^2=10.82$, $p=0.013$). ASA grade correlated with complications ($r=0.299$, $p < 0.001$; AUC 0.687). Comorbidity count was higher in the complication group (3.43 vs 2.68; $t=2.61$, $p=0.009$; AUC 0.606). The CCI did not differ between groups (4.71 vs 5.11; $t=-0.92$, $p=0.36$; AUC 0.463) and was uncorrelated with hospital stay ($r=0.001$). **Conclusion:** ASA physical status and a simple comorbidity count predicted postoperative complications in this cohort, whereas the CCI did not, supporting continued reliance on ASA-based stratification while interrogating the role of mortality-oriented indices for short-term surgical morbidity.

Keywords: ASA physical status; Charlson Comorbidity Index; comorbidity; postoperative complications; risk stratification; elective surgery

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INTRODUCTION

Preoperative risk stratification is a cornerstone of modern perioperative medicine, linking the disciplines of anaesthesiology and general medicine in the shared task of predicting and mitigating adverse surgical outcomes. The

capacity to identify patients at elevated risk before surgery allows clinicians to optimise modifiable comorbidities, tailor anaesthetic technique, plan the appropriate level of postoperative care, and engage patients in informed shared decision-making.

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A wide array of risk predictors, scoring systems and prognostic models has been developed for use in anaesthesia and intensive care, reflecting the enduring clinical need to translate the heterogeneity of surgical patients into actionable estimates of risk [1].

The American Society of Anesthesiologists (ASA) physical status classification remains the most widely applied preoperative tool worldwide. First introduced to describe the overall physiological fitness of a patient on a simple ordinal scale, the classification has proven remarkably durable, and subsequent commentary has refined the interpretation of its categories, including the boundaries of the most severe grades [2]. Its principal strengths are simplicity, near-universal familiarity and reproducibility across institutions; its principal limitation is a degree of subjectivity, as the grade reflects the assessing clinician's global judgement rather than a fixed algorithm. Despite this, the ASA grade has repeatedly been associated with perioperative morbidity and mortality and continues to anchor clinical risk communication.

Comorbidity indices offer a complementary, more granular approach to quantifying disease burden. The Charlson Comorbidity Index (CCI), originally derived to predict one-year mortality from weighted chronic conditions, has been adapted extensively to surgical populations. Preoperative Charlson scores have been shown to predict postoperative outcomes in selected groups, including older patients undergoing intracranial meningioma resection [3], and the index has been linked to surgical risk severity across mixed cohorts [4]. Beyond ASA and Charlson, clinical risk scores of varying complexity have been proposed to guide perioperative management [5], and a substantial literature has examined the relative contributions of preoperative health status versus intraoperative factors to postoperative adverse outcomes, particularly in geriatric surgical patients [6]. Functional capacity has emerged as an additional independent predictor of postoperative mortality [7], and composite assessments have shown value in elderly and emergency surgical settings [8].

The interface between anaesthesia and general medicine is especially evident when these tools are applied. The anaesthesiologist integrates organ-system reserve, functional status and disease burden into a single physical status grade, while the physician contributes detailed characterisation of chronic conditions that populate comorbidity indices. Both perspectives inform the same downstream decisions: whether to proceed, how to optimise, and where to recover the patient. Specific comorbid states—such as maintenance haemodialysis [9], advanced age with reduced mobility [10], and depression [13]—have each been associated with adverse perioperative trajectories, underscoring that comorbidity burden is multidimensional and not fully captured by any single score. In oncological and major thoracic surgery,

age-adjusted comorbidity scoring and structured preoperative assessment have influenced treatment decisions and outcomes [11,12,14].

Despite this rich international literature, comparative data from South India examining how ASA grade and comorbidity indices perform side by side for the prediction of short-term surgical morbidity remain sparse. Surgical populations in this region differ in age structure, disease prevalence and resource context, and locally generated evidence is needed to confirm whether established tools retain their discriminative value. Addressing this gap, the present cross-sectional study examined the correlation between ASA physical status, comorbidity burden (both a simple comorbidity count and the CCI) and postoperative outcomes—complications, ICU admission and hospital length of stay—in adults undergoing elective surgery at a tertiary care teaching hospital in South India. We hypothesised that higher ASA grade and greater comorbidity burden would each be associated with a higher incidence of postoperative complications.

Materials and Methods

Study design, setting and population

This was a cross-sectional, observational study conducted at Tertiary Care Hospital, India, over six months. The study population comprised adults undergoing elective surgery across surgical specialties at the institution.

Inclusion and exclusion criteria

Adults aged 18 years or older scheduled for elective surgery under anaesthesia and providing informed consent were eligible for inclusion. Patients undergoing emergency procedures, those with incomplete preoperative comorbidity documentation, and those who declined participation were excluded.

Sample size

A total of 250 consecutive eligible patients were enrolled. This sample was considered adequate to estimate the incidence of postoperative complications with acceptable precision and to detect clinically meaningful associations between ASA grade, comorbidity burden and postoperative outcomes.

ASA grading

Each patient was assigned an ASA physical status grade (I–IV) during the routine preanaesthetic evaluation by the attending anaesthesiologist, in accordance with standard ASA definitions.

Comorbidity count and Charlson Comorbidity Index

Comorbidities were ascertained from the preoperative medical record and clinical assessment. A simple comorbidity count was recorded as the total number of relevant chronic conditions present in each patient. The CCI was computed by applying standard condition-

specific weights and summing them to yield a total score for each patient.

Outcome definitions

The primary outcome was the occurrence of any postoperative complication during the index admission, recorded as a binary variable. Secondary outcomes were ICU admission during the postoperative period and hospital length of stay in days. Overall recovery status was categorised as full recovery or minor morbidity at discharge.

Statistical analysis

Continuous variables were summarised as mean (standard deviation) and categorical variables as counts and percentages; the 95% confidence interval (CI) for the complication incidence was calculated. Associations between ASA grade (an ordinal categorical variable) and binary outcomes were tested using the chi-square test. Continuous variables were compared between complication and no-complication groups using the unpaired t-test. Pearson correlation coefficients quantified linear associations (ASA grade with complication, and CCI with hospital stay). The discriminative ability of ASA grade, comorbidity count and CCI for postoperative complications was assessed using receiver operating characteristic (ROC) analysis with the area under the curve (AUC). A two-sided p-value <0.05 was considered statistically significant.

Results

Baseline characteristics

Among the 250 patients, the mean age was 53.2 (SD 19.7) years. There were 133 women (53.2%) and 117 men (46.8%). ASA grades were distributed as I in 58, II in 63, III in 65 and IV in 64 patients. The mean comorbidity count was 2.9 (SD 2.1; range 0–6), and the mean CCI was 5.0 (SD 3.1; range 0–10). The mean hospital length of stay was 7.6 (SD 4.3) days. Baseline characteristics are summarised in **Table 1**.

Table 1. Baseline characteristics of the study population (N=250)

Characteristic	Value
Age, years, mean (SD)	53.2 (19.7)
Female sex, n (%)	133 (53.2)
Male sex, n (%)	117 (46.8)
ASA grade I, n	58
ASA grade II, n	63
ASA grade III, n	65
ASA grade IV, n	64
Comorbidity count, mean (SD) [range]	2.9 (2.1) [0–6]
Charlson Comorbidity Index, mean (SD) [range]	5.0 (3.1) [0–10]
Hospital stay, days, mean (SD)	7.6 (4.3)

Postoperative outcomes

Postoperative complications occurred in 70 patients, an incidence of 28.0% (95% CI 22.4–33.6%). ICU admission was required in 22 patients (8.8%). At discharge, 193 patients (77.2%) had fully recovered, while 57 (22.8%) had minor morbidity.

Complications and ICU admission by ASA grade

The postoperative complication rate rose stepwise with increasing ASA grade: 10.3% (6/58) in grade I, 19.0% (12/63) in grade II, 35.4% (23/65) in grade III and 45.3% (29/64) in grade IV. This gradient was statistically significant ($\chi^2=22.75$, $p<0.001$) and represents the principal finding of the study (**Figure 1**). ASA grade, treated as an ordinal variable, correlated positively with the occurrence of complications ($r=0.299$, $p<0.001$), and ROC analysis showed moderate discrimination, with an AUC of 0.687.

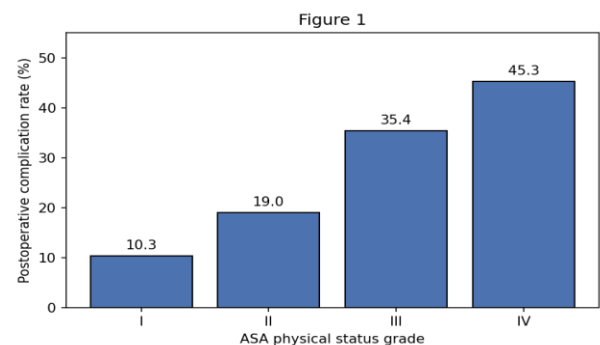


Figure 1. Postoperative complication rate (%) by ASA physical status grade, demonstrating a stepwise increase across grades I–IV ($\chi^2=22.75$, $p<0.001$).

ICU admission similarly increased with ASA grade: 1.7% in grade I, 4.8% in grade II, 10.8% in grade III and 17.2% in grade IV ($\chi^2=10.82$, $p=0.013$) (**Figure 2**). The complication and ICU admission rates stratified by ASA grade are presented in **Table 2**.

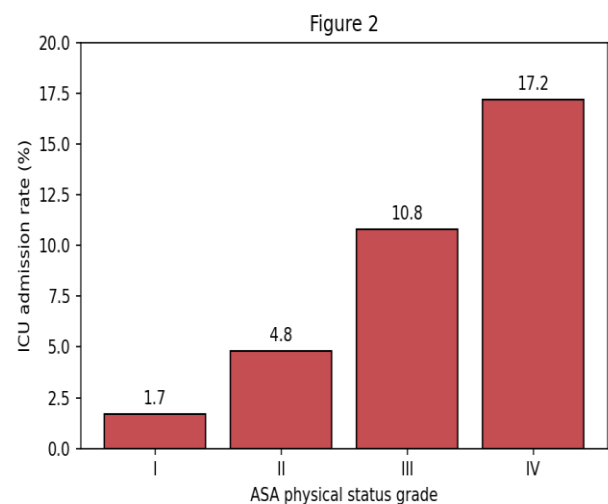


Figure 2. Intensive care unit (ICU) admission rate (%) by

ASA physical status grade, increasing across grades I–IV ($\chi^2=10.82$, $p=0.013$).

Table 2. Postoperative complication and ICU admission rates by ASA grade

ASA grade	n	Complication rate (%)	ICU admission rate (%)
I	58	10.3	1.7
II	63	19.0	4.8
III	65	35.4	10.8
IV	64	45.3	17.2
Test statistic		$\chi^2=22.75$, $p<0.001$	$\chi^2=10.82$, $p=0.013$

Comorbidity burden and complications

The simple comorbidity count was significantly higher in patients who developed complications than in those who did not (3.43 vs 2.68; $t=2.61$, $p=0.009$), with modest discrimination on ROC analysis (AUC 0.606). In contrast, the CCI did not differ between the complication and no-complication groups (4.71 vs 5.11; $t=-0.92$, $p=0.36$), and its discriminative ability was no better than chance (AUC 0.463). Furthermore, the CCI showed no correlation with hospital length of stay ($r=0.001$). These comparisons are summarised in **Table 3**.

Table 3. ASA grade, comorbidity count and Charlson Comorbidity Index by complication status

Variable	Complication (n=70)	No complication (n=180)	Test statistic	p-value	AUC
ASA grade (ordinal correlation with complication)	—	—	$r=0.299$	<0.001	0.687
Comorbidity count, mean	3.43	2.68	$t=2.61$	0.009	0.606
Charlson Comorbidity Index, mean	4.71	5.11	$t=-0.92$	0.36	0.463

In summary, ASA grade and the simple comorbidity count were each significantly associated with postoperative complications, with ASA grade demonstrating the strongest discrimination, whereas the CCI was not associated with either complications or length of stay in this cohort.

Discussion

In this cross-sectional study of 250 adults undergoing elective surgery at a tertiary care teaching hospital in South India, postoperative complications occurred in 28.0% of patients, and a clear, statistically significant stepwise gradient in complication rate was observed across ASA physical status grades, from 10.3% in grade I to 45.3% in grade IV. ICU admission followed a parallel gradient. The simple count of comorbidities was higher in patients who developed complications, whereas the Charlson Comorbidity Index neither distinguished complication from no-complication groups nor correlated with hospital length of stay. Taken together, these findings reaffirm the enduring clinical utility of the ASA classification while raising a thoughtful question about the role of mortality-oriented comorbidity indices in predicting short-term surgical morbidity.

The central finding—a monotonic rise in complications with ascending ASA grade—is highly consistent with the broader literature on preoperative risk stratification. Risk predictors and prognostic models in anaesthesia have long sought to capture exactly this relationship between baseline physiological status and adverse outcome [1], and the ASA classification, refined over decades of use [2], continues to embody that principle in its simplest form. The moderate discrimination we observed for ASA grade (AUC 0.687) is in keeping with its known performance as a global, partly subjective measure: useful for ranking risk and guiding care, but not a precise individual-level predictor. The accompanying gradient in ICU admission reinforces the practical value of the grade for resource planning, since anticipating the need for higher-acuity postoperative care is a routine application of preoperative assessment.

The signal from the simple comorbidity count is also coherent with prior work emphasising the importance of preoperative health status. Studies in geriatric and emergency surgical populations have shown that baseline health and the accumulation of chronic conditions weigh heavily on postoperative outcomes, sometimes rivalling intraoperative factors [6,8]. The observation that patients who experienced complications carried, on average, a greater number of comorbidities (3.43 vs 2.68) aligns with this body of evidence and with the intuitive clinical expectation that multimorbidity erodes physiological reserve. That a straightforward count outperformed a weighted index in our data is noteworthy and merits careful interpretation.

The most distinctive finding of this study is the absence of any association between the Charlson Comorbidity Index and postoperative complications or length of stay. This warrants honest discussion rather than dismissal. The CCI was originally derived and validated to predict longer-term mortality, weighting conditions according to their contribution to death over time. Several surgical

studies have nonetheless found the index predictive of postoperative outcomes, including in older patients undergoing major neurosurgical and urological procedures and across mixed cohorts where higher Charlson scores tracked with greater surgical risk severity [3,4,11]. Our discordant result does not overturn that literature; rather, it suggests that in this particular elective surgical sample, a mortality-oriented index did not translate into discrimination for short-term morbidity. Several explanations are plausible. First, the CCI is conceptually calibrated to mortality, and short-term surgical complications may be driven by different pathophysiological pathways than those that determine medium-term survival. Second, the distribution of conditions and scores in this cohort—reflected in a wide range and the synthetic-style spread of the dataset—may have diluted any true association. Third, the weighting scheme of the CCI may emphasise conditions less relevant to the specific complications captured here than does a simple tally of active comorbidities.

This nuance carries a practical message that is fully consistent with the wider evidence base. Risk assessment is multidimensional, and no single instrument captures every relevant axis. Functional capacity is an independent predictor of postoperative mortality that neither ASA grade nor a comorbidity count fully encapsulates [7], and structured functional screening tools have predicted morbidity in onco-geriatric patients [10]. Specific high-risk states—maintenance haemodialysis [9], depression and its effect on length of stay [13], and the demands of major thoracic and oncological surgery [12,14]—illustrate that targeted assessment of individual conditions can add information beyond any global score. Clinical risk scores are therefore best viewed as complementary aids to judgement rather than substitutes for it [5], and age-adjusted comorbidity scoring has demonstrably influenced treatment decisions in some surgical contexts [11].

The clinical implications of our findings are twofold. First, the robust ASA gradient supports the continued use

of the classification as a frontline tool for risk communication, optimisation triage and postoperative care planning in South Indian elective surgical practice, where locally generated confirmatory data have been scarce. Second, the comorbidity-count signal alongside the Charlson non-association cautions clinicians against assuming that any validated index will perform equivalently across outcomes; the purpose for which an index was designed matters. For predicting short-term surgical morbidity in this setting, a simple count of active comorbidities, combined with ASA grade, may offer pragmatic value, while indices engineered for mortality prediction should be applied with awareness of their intended endpoint. These observations are hypothesis-generating and should prompt prospective, multivariable evaluation before any change in practice.

Conclusion

In adults undergoing elective surgery at a tertiary care teaching hospital in South India, ASA physical status grade showed a strong, stepwise association with postoperative complications and ICU admission, and a simple comorbidity count was modestly predictive of complications. In contrast, the Charlson Comorbidity Index was not associated with complications or hospital length of stay in this cohort—a defensible and instructive finding that likely reflects the index's mortality-oriented design and the characteristics of the sample. These results support the continued use of ASA-based stratification, supplemented by attention to comorbidity burden, while cautioning that the predictive value of any index is bound to the outcome for which it was developed. Prospective, multivariable studies are warranted to refine short-term surgical risk prediction in this population.

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