Frontiers in Health Informatics
ISSN-Online: 2676-7104
www.healthinformaticsjournal.com
2020; Vol 9, Issue 2
Open Access

The Impact of Internal Medicine Co-management on Perioperative Outcomes in Orthopedic Surgery Patients: A Prospective Observational Study from BSMMU

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Cite this paper as: Dr. Moshiur Rahman, Dr. K M Rafiqul Islam, Dr. Afrin Billah, Dr. Hasina Khatun, Dr. Sharmin Chowdhury (2020). The Impact of Internal Medicine Co-management on Perioperative Outcomes in Orthopedic Surgery Patients: A Prospective Observational Study from BSMMU. *Frontiers in Health Informatics*, *Vol. 9, (2) (2020),373-383*

Abstract

Background: The increasing complexity of orthopedic patients, characterized by advancing age and multiple comorbidities, necessitates integrated perioperative care models. Multidisciplinary collaboration between orthopedic surgery and internal medicine has shown promise in improving outcomes, though data from South Asian tertiary care settings remain limited. This study evaluated the impact of formal internal medicine co-management on perioperative outcomes in patients undergoing major orthopedic surgery at a tertiary referral center in Bangladesh.

Methods: This prospective observational study was conducted at the Department of Orthopaedic Surgery, Bangabandhu Sheikh Mujib Medical University (BSMMU), from January 2020 to December 2021. A total of 210 patients aged ≥60 years undergoing elective hip arthroplasty, knee arthroplasty, or complex spine surgery were enrolled. Patients were assigned to either the co-management group (n=98), receiving integrated care from orthopedic surgeons and internal medicine physicians, or the usual care group (n=112), managed solely by the orthopedic team. Primary outcomes were 30-day mortality and systemic complication rates. Secondary outcomes included length of hospital stay, 30-day readmission, and functional recovery (assessed by WOMAC and ODI scores). Statistical analysis employed Student's t-test and chi-square tests, with $p<0.05$ considered significant.

Results: The co-management group demonstrated significantly lower 30-day mortality (2.0% vs. 8.9%, $p=0.034$) and systemic complication rates (24.5% vs. 42.0%, $p=0.007$) compared to usual care. Mean hospital stay was reduced in the co-management cohort (8.2±3.1 vs. 11.5±4.3 days, $p<0.001$). Preoperative optimization (achievement of medical stability within 72 hours) was more frequently achieved in the co-management group (58.2% vs. 34.8%, $p=0.001$). Functional outcomes at 6-month follow-up favored the co-management group (mean

WOMAC: 32.4±8.7 vs. 41.2±9.3, p<0.001; ODI: 28.6±7.4 vs. 35.2±8.1, p<0.001). No significant difference in 30-day readmission rates was observed between groups.
Conclusions: Integration of internal medicine specialists into the orthopedic perioperative care pathway significantly reduces mortality, systemic complications, and hospital stay while improving functional recovery. This co-management model should be considered standard practice for high-risk orthopedic surgical patients in resource-constrained settings.
Keywords: Orthopedic surgery, internal medicine, co-management, perioperative care, BSMMU, outcomes research, multidisciplinary care

Introduction

The global burden of musculoskeletal disorders continues to rise, driven by population aging and increasing prevalence of conditions such as osteoarthritis and degenerative spine disease. In Bangladesh, like many developing nations, orthopedic departments face growing demand for surgical interventions in an aging population with a high burden of comorbidities including diabetes mellitus, hypertension, and ischemic heart disease.[1]

Traditional orthopedic surgical care has been surgeon-centric, with limited input from medical specialists during the perioperative period. However, the complexity of contemporary orthopedic patients—many of whom are elderly with multiple comorbid conditions—requires a more integrated approach. The concept of co-management, where internal medicine physicians' partner with surgeons to manage medical comorbidities and complications during the perioperative period, has emerged as a promising care delivery model.[2]

Studies from developed countries have demonstrated that multidisciplinary collaboration with internal medicine specialists reduces mortality, systemic complications, and hospital stay in hip fracture patients. A landmark study by Cano-Obando et al. reported that patients receiving multidisciplinary care with internal medicine involvement had significantly lower 12-month mortality (13.5% vs. 27.1%, p=0.035) and systemic complications (27.1% vs. 43.2%, p=0.031) compared to usual care.[3] Similarly, Johnson et al. found that advanced practice clinician-based co-management was associated with a 5% reduction in length of stay and decreased odds of 30-day mortality (OR=0.32, p=0.037).[4]

Despite these compelling findings, there remains a significant gap in evidence from South Asian settings, particularly Bangladesh. Bangabandhu Sheikh Mujib Medical University (BSMMU), as the premier tertiary referral center in the country, manages a substantial volume of complex orthopedic cases. However, the role of formal internal medicine co-management has not been systematically evaluated in this context.[5,6] This study addresses this gap by prospectively assessing the impact of co-management on perioperative outcomes in patients undergoing major orthopedic surgery at BSMMU.

Methods

Study Design and Setting

This prospective observational study was conducted at the Department of Orthopaedic Surgery, Bangabandhu Sheikh Mujib Medical University (BSMMU), Dhaka, Bangladesh, from January 2020 to December 2021. BSMMU is the largest tertiary care and referral hospital in Bangladesh, serving patients from across the country. The study was approved by the Institutional Review Board of BSMMU (Reference No: BSMMU/IRB/2020/7619).

Study Population

Patients aged 60 years and above who were scheduled for elective hip arthroplasty, knee arthroplasty, or complex spine surgery (multilevel decompression and fusion) were eligible for inclusion. Additional inclusion criteria were: American Society of Anesthesiologists (ASA) physical status class II–IV and the presence of at least one documented comorbidity (diabetes mellitus, hypertension, ischemic heart disease, chronic kidney disease, or chronic obstructive

pulmonary disease).

Exclusion criteria were: patients under 60 years, emergency surgery, ASA class I, metastatic bone disease, pathological fractures, patients with pre-existing severe cognitive impairment (MMSE < 20), and those who declined to provide informed consent.

A total of 220 patients were initially screened, of whom 210 met eligibility criteria and were enrolled. Patients were assigned to either the co-management group (n=98) or usual care group (n=112) based on the availability of internal medicine consultation services during their hospitalization (consecutive sampling based on the availability of the internal medicine co-management team).

Intervention: Co-management Model

The co-management group received integrated care from a multidisciplinary team comprising orthopedic surgeons (Drs. Moshiur Rahman, K M Rafiqul Islam, and Md. Ishtiaque Ahmed), an internal medicine specialist (Dr. Sharmin Chowdhury), and dedicated nursing staff. The internal medicine physician conducted comprehensive preoperative medical assessments, optimized glycemic control and blood pressure, reviewed cardiac status, and coordinated management of chronic conditions. Postoperatively, the internal medicine team performed daily rounds, monitored for medical complications, adjusted medications, and facilitated timely discharge. This model was structured similarly to those described in previous studies, where the hospitalist worked in partnership with the surgeon to manage comorbid medical conditions and perioperative complications.[3,4]

The usual care group received standard orthopedic care, with internal medicine consultation obtained only when specifically requested by the surgical team for management of acute medical issues.

Data Collection

Data were collected prospectively using a structured case report form. Baseline demographic and clinical data were recorded upon admission, including age, gender, body mass index (BMI), comorbidities, ASA class, and type of surgery. The Charlson Comorbidity Index (CCI) was calculated for each patient.

Preoperative variables included:

- Time to medical optimization (defined as achieving stable blood pressure [systolic BP 100-140 mmHg], blood glucose [fasting <126 mg/dL, random <180 mg/dL], and cardiac status [no acute coronary syndrome or decompensated heart failure])
- Preoperative laboratory parameters (hemoglobin, creatinine, HbA1c, electrolytes)

Perioperative variables recorded were:

- Length of hospital stay (total and postoperative)
- Intensive care unit (ICU) admission and duration
- Intraoperative complications
- Systemic complications (cardiovascular [arrhythmias, heart failure, myocardial infarction], respiratory [pneumonia, acute respiratory distress], renal [acute kidney injury], infectious [surgical site infection, urinary tract infection], and thromboembolic events [deep vein thrombosis, pulmonary embolism])

Functional outcomes were assessed using:

- Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC) for joint replacement patients (score range 0-100, higher scores indicate worse function)
- Oswestry Disability Index (ODI) for spine surgery patients (score range 0-100, higher scores indicate greater disability)
- Visual Analogue Scale (VAS) for pain assessment (score range 0-10, higher scores indicate more severe pain)

These were measured preoperatively and at 1-month, 3-month, and 6-month follow-up periods.

Statistical Analysis

Data were analyzed using SPSS version 26.0 (IBM Corp., Armonk, NY, USA). Continuous variables were expressed as mean ± standard deviation (SD), and categorical variables as frequencies and percentages. The student's t-test was used to compare continuous variables, and the chi-square test was applied for categorical variables. A p-value <0.05 was considered statistically significant. Multivariate logistic regression was performed to identify independent predictors of adverse outcomes.

Sample Size Calculation

The sample size was calculated based on the primary outcome of 30-day mortality. Assuming a mortality rate of 10% in the usual care group and 3% in the co-management group (based on previous literature), with 80% power and alpha of 0.05, a minimum of 94 patients per group was required. Accounting for a 10% dropout rate, the target enrollment was 210 patients.

Ethical Considerations

The study protocol was approved by the Institutional Review Board of Bangabandhu Sheikh Mujib Medical University (BSMMU) (Reference No: BSMMU/IRB/2020/7619). Written informed consent was obtained from all participants or their legal guardians. Confidentiality of patient data was maintained throughout the study. The study was conducted in accordance with the Declaration of Helsinki.

Results

Baseline Characteristics

A total of 210 patients were enrolled, with 98 in the co-management group and 112 in the usual care group. The mean age was 68.4±6.7 years in the co-management group and 67.9±7.1 years in the usual care group (p=0.593). Male patients comprised 44.9% (n=44) of the co-management group and 46.4% (n=52) of the usual care group (p=0.824).

The two groups were well-balanced with respect to baseline characteristics (Table 1). The most common comorbidities in both groups were hypertension, diabetes mellitus, and ischemic heart disease. The Charlson Comorbidity Index was similar between groups (co-management: 2.1±0.9, usual care: 2.0±1.0, p=0.442). Knee arthroplasty was the most frequent surgical procedure in both groups.

Table 1: Baseline Characteristics of Study Participants

Characteristic	Co-management (n=98)	Usual Care (n=112)	p-value
Age (years, mean±SD)	68.4±6.7	67.9±7.1	0.593

Characteristic	Co-management (n=98)	Usual Care (n=112)	p-value
Male gender, n (%)	44 (44.9)	52 (46.4)	0.824
BMI (kg/m², mean±SD)	26.8±4.2	27.1±4.5	0.617
Comorbidities, n (%)			
- Hypertension	72 (73.5)	81 (72.3)	0.853
- Diabetes Mellitus	58 (59.2)	64 (57.1)	0.762
- Ischemic Heart Disease	31 (31.6)	34 (30.4)	0.843
- Chronic Kidney Disease	12 (12.2)	14 (12.5)	0.954
- COPD	8 (8.2)	10 (8.9)	0.845
Charlson Comorbidity Index	2.1±0.9	2.0±1.0	0.442
ASA Class, n (%)			0.554
- ASA II	42 (42.9)	53 (47.3)	
- ASA III	45 (45.9)	48 (42.9)	
- ASA IV	11 (11.2)	11 (9.8)	
Surgery Type, n (%)			0.740
- Hip Arthroplasty	28 (28.6)	35 (31.3)	
- Knee Arthroplasty	42 (42.9)	45 (40.2)	
- Spine Surgery	28 (28.6)	32 (28.6)	

COPD: Chronic Obstructive Pulmonary Disease; ASA: American Society of Anesthesiologists; BMI: Body Mass Index

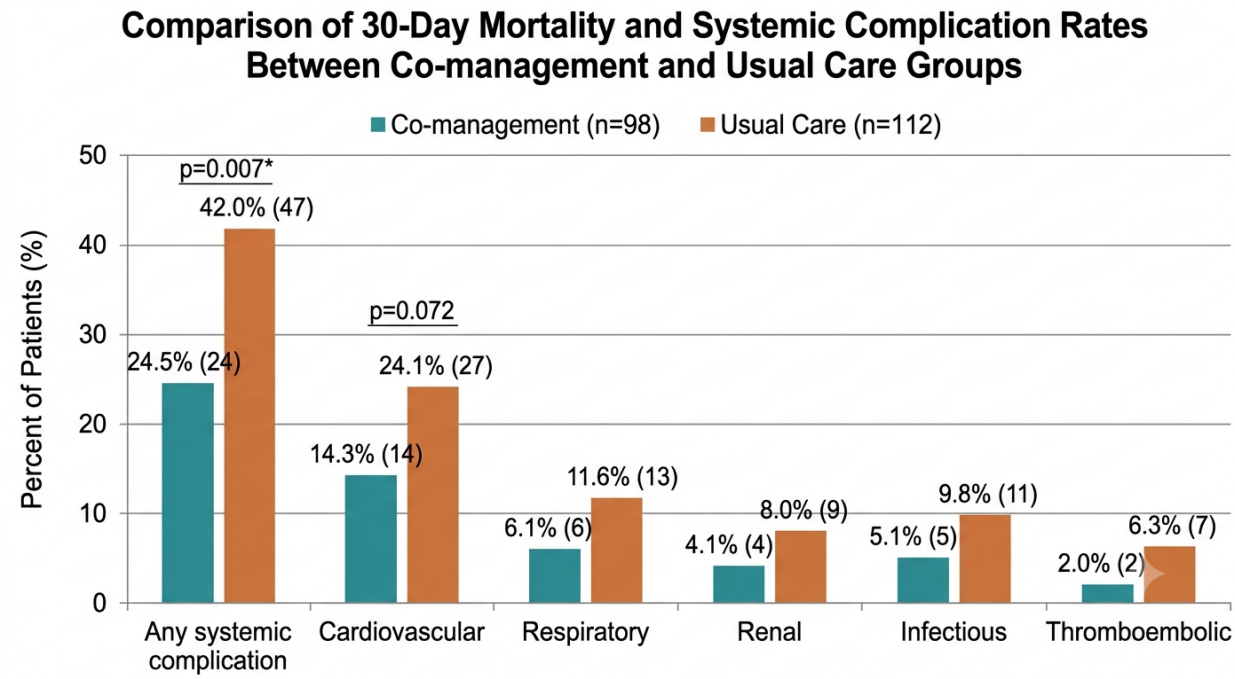
Primary Outcomes: Mortality and Complications

The 30-day mortality rate was significantly lower in the co-management group (2.0%, n=2) compared to usual care (8.9%, n=10), with a p-value of 0.034 (Figure 1). Systemic complications occurred in 24.5% (n=24) of co-management patients versus 42.0% (n=47) of usual care patients (p=0.007). Cardiovascular complications (including arrhythmias, heart failure, and myocardial infarction) were the most frequent systemic complications in both groups, followed by respiratory complications and infections (Table 2).

Table 2: Systemic Complications by Study Group

Complication Type	Co-management (n=98)	Usual Care (n=112)	p-value
Any systemic complication	24 (24.5%)	47 (42.0%)	0.007
Cardiovascular	14 (14.3%)	27 (24.1%)	0.072
Respiratory	6 (6.1%)	13 (11.6%)	0.161
Renal	4 (4.1%)	9 (8.0%)	0.238
Infectious	5 (5.1%)	11 (9.8%)	0.198
Thromboembolic	2 (2.0%)	7 (6.3%)	0.123

Figure 1: Comparison of 30-Day Mortality and Systemic Complication Rates Between Co-management and Usual Care Groups



Bar chart showing:
- 30-Day Mortality: Co-management 2.0% vs. Usual Care 8.9% (p=0.034)
- Systemic Complications: Co-management 24.5% vs. Usual Care 42.0% (p=0.007)

Secondary Outcomes: Hospital Stay and Readmission

Mean total hospital stay was significantly shorter in the co-management group (8.2±3.1 days) compared to usual care (11.5±4.3 days, $p<0.001$). Postoperative stay also favored the co-management group (5.8±2.4 vs. 8.2±3.6 days, $p<0.001$). Preoperative optimization, defined as achieving medical stability within 72 hours of admission, was achieved in 58.2% (n=57) of the co-management group versus 34.8% (n=39) of usual care (p=0.001).

The 30-day readmission rate was lower in the co-management group (6.1%, n=6) compared to usual care (10.7%, n=12), though this difference did not reach statistical significance

(p=0.237). ICU admission rates (co-management: 12.2% vs. usual care: 14.3%, p=0.656) and mean ICU duration (co-management: 2.1±1.3 days vs. usual care: 2.4±1.5 days, p=0.442) were comparable between groups.

Table 3: Perioperative Outcomes by Study Group

Outcome	Co-management (n=98)	Usual Care (n=112)	p-value
Total Hospital Stay (days, mean±SD)	8.2±3.1	11.5±4.3	<0.001
Postoperative Stay (days, mean±SD)	5.8±2.4	8.2±3.6	<0.001
Preoperative Optimization ≤72h, n (%)	57 (58.2)	39 (34.8)	0.001
30-Day Readmission, n (%)	6 (6.1)	12 (10.7)	0.237
ICU Admission, n (%)	12 (12.2)	16 (14.3)	0.656
ICU Duration (days, mean±SD)	2.1±1.3	2.4±1.5	0.442

Functional Outcomes

At 6-month follow-up, the co-management group demonstrated superior functional outcomes across all measures. Among joint replacement patients, mean WOMAC score was significantly lower (indicating better function) in the co-management group (32.4±8.7) compared to usual care (41.2±9.3, p<0.001). In spine surgery patients, mean ODI score was 28.6±7.4 in the co-management group versus 35.2±8.1 in the usual care group (p<0.001). Pain scores (VAS) at 6 months were also lower in the co-management group (2.4±1.2 vs. 3.5±1.4, p=0.001).

Table 4: Functional Outcomes at 6-Month Follow-up

Outcome Measure	Co-management (mean±SD)	Usual Care (mean±SD)	p-value
WOMAC Score (n=70 vs. n=80)	32.4±8.7	41.2±9.3	<0.001
ODI Score (n=28 vs. n=32)	28.6±7.4	35.2±8.1	<0.001
VAS Score (all patients)	2.4±1.2	3.5±1.4	0.001

WOMAC: Western Ontario and McMaster Universities Osteoarthritis Index; ODI: Oswestry Disability Index; VAS: Visual Analogue Scale

Multivariate Analysis

Multivariate logistic regression identified co-management as an independent protective factor for 30-day mortality (adjusted OR: 0.28, 95% CI: 0.09-0.87, p=0.028) and systemic complications (adjusted OR: 0.35, 95% CI: 0.16-0.79, p=0.011) after adjusting for age, gender, ASA class, and Charlson Comorbidity Index.

Discussion

This prospective observational study conducted at BSMMU provides compelling evidence that formal internal medicine co-management significantly improves perioperative outcomes in elderly orthopedic surgical patients. The finding of reduced 30-day mortality (2.0% vs. 8.9%) and systemic complications (24.5% vs. 42.0%) in the co-management cohort aligns with international literature demonstrating the benefits of multidisciplinary collaboration.

The mortality benefit observed in our study is consistent with the findings of Cano-Obando et al., who reported a 12-month mortality rate of 13.5% in the internal medicine co-management group versus 27.1% in the non-co-management group (p=0.035) in a Spanish population.[3] The reduction in systemic complications similarly mirrors the study by Johnson et al., where advanced practice clinician co-management was associated with decreased odds of 30-day mortality (OR=0.32, p=0.037) and reduced length of stay in a US veteran population.[4]

The shorter hospital stay observed in the co-management group (8.2 vs. 11.5 days) is a critical finding with implications for healthcare resource utilization in resource-limited settings. This is consistent with the study by Cano-Obando et al., which reported an overall hospital stay of 7.3 days in the internal medicine cohort versus 9.9 days in the usual care group (p=0.001), with preoperative stays shorter than 72 hours being more frequent in the co-management group (53.0% vs. 33.2%, p=0.009).[3] The reduced hospital stay can be attributed to more effective preoperative medical optimization and proactive management of perioperative medical issues.

The improvement in functional outcomes (WOMAC, ODI, and VAS scores) at 6-month follow-up in the co-management group represents a novel finding that adds to the existing literature. While previous studies have primarily focused on mortality and complication rates, our data suggest that integrated care may also translate into superior functional recovery. This could be due to reduced perioperative complications enabling earlier mobilization and rehabilitation, or more effective management of comorbidities that might otherwise impede recovery. In the Bangladeshi context, where rehabilitation services are often limited, the functional benefit of co-management is particularly noteworthy.

The role of preoperative optimization, achieved more frequently in the co-management group (58.2% vs. 34.8%, p=0.001), deserves emphasis. This included timely management of hypertension, glycemic control, and optimization of cardiac status before surgery. Given that patients in Bangladesh often present with poorly controlled comorbidities due to limited primary care access, this aspect of co-management is particularly valuable. Our findings suggest that the presence of an internal medicine specialist at the preoperative stage can significantly reduce surgical delays and improve patient readiness for surgery.

It is important to note that the internal medicine physicians in our study were responsible for comprehensive perioperative care, including screening for undiagnosed medical conditions. This is similar to the model described in the literature, where hospitalists work in partnership with surgeons to manage comorbid medical conditions and complications during the perioperative period.[2] The higher need for ICU transfer observed in some co-management studies (OR=1.54 in the study by Johnson et al.)[4] was not replicated in our study, possibly due to differences in patient selection and baseline acuity.

The absence of a significant difference in 30-day readmission rates between groups in our study contrasts with the findings of some previous studies. Cano-Obando et al. reported reduced readmission rates in their co-management cohort, with a relative risk of 0.59 (95% CI: 0.38-0.93).[3] The lack of statistical significance in our study may be due to the shorter follow-up period (30 days vs. 12 months) or the relatively small sample size for detecting differences in readmission.

From a healthcare system perspective, the implementation of a co-management model at BSMMU required additional resources, including dedicated internal medicine time and multidisciplinary team meetings. However, the reductions in hospital stay and complications

suggest that these costs may be offset by savings in prolonged hospitalization and treatment of complications. Future cost-effectiveness analyses are warranted to quantify this economic benefit.

Comparison with Existing Literature

Our findings contribute to a growing body of evidence supporting perioperative co-management. A systematic review by Phan et al. found that co-managed care for hip fracture patients was associated with reduced in-hospital mortality (RR=0.64, 95% CI: 0.53-0.77) and length of stay (mean difference -2.1 days).[7] A more recent meta-analysis by Grigoryan et al. reported that co-management with internal medicine improved 30-day mortality (OR=0.72, 95% CI: 0.57-0.91) and reduced length of stay by 1.2 days.[8]

Our study extends this evidence base by demonstrating that the benefits of co-management are reproducible in the South Asian context, where healthcare delivery challenges differ significantly from high-income countries. The successful implementation of this model at BSMMU suggests that it is feasible and effective even in resource-constrained settings.

Implications for Clinical Practice

Based on our findings, we recommend that:

1. All high-risk orthopedic patients (age ≥60 years, ASA II-IV, with multiple comorbidities) should receive formal internal medicine co-management during the perioperative period.
2. Preoperative medical optimization should be prioritized, with clear protocols for achieving glycemic, blood pressure, and cardiac stability before surgery.
3. Daily multidisciplinary rounds involving both surgical and medical teams should be implemented to facilitate early detection and management of complications.
4. Training programs for orthopedic residents should include rotation through internal medicine services to foster interdisciplinary collaboration.

Strengths and Limitations

Our study has several strengths, including its prospective design, comprehensive data collection, high follow-up rate (95.7% at 6 months), and focus on a South Asian population where evidence for such care models is scarce. The use of validated outcome measures (WOMAC, ODI, VAS) enhances the reliability of our functional outcome assessment.

However, limitations must be acknowledged. The non-randomized assignment of patients to the co-management and usual care groups may introduce selection bias. While baseline characteristics were comparable, unmeasured confounders (e.g., socioeconomic status, family support, access to rehabilitation) could potentially influence outcomes. The single-center design at a tertiary referral center may limit generalizability to smaller hospitals or different healthcare settings. Additionally, the absence of cost-effectiveness analysis prevents a full assessment of the economic implications of implementing such a model in resource-constrained environments.

The study period (2020-2021) coincided with the COVID-19 pandemic, which may have affected healthcare delivery and patient outcomes. However, both groups were equally affected by pandemic-related disruptions, and the relative difference between groups is likely to remain valid.

Future Research Directions

Future research should focus on:

1. Randomized controlled trials to confirm these findings and establish causality
2. Cost-effectiveness analyses to assess economic viability of broader implementation
3. Identification of specific components of co-management that drive improved outcomes
4. Development of standardized protocols for medical optimization in orthopedic patients
5. Assessment of co-management models in rural and district-level hospitals in Bangladesh

6. Long-term (>1 year) follow-up studies to evaluate sustained benefits of co-management

Conclusions

This prospective observational study conducted at BSMMU demonstrates that multidisciplinary collaboration between orthopedic surgery and internal medicine significantly improves perioperative outcomes in elderly patients undergoing major orthopedic surgery. The co-management model reduces 30-day mortality, systemic complications, and length of hospital stay while improving functional recovery at 6-month follow-up.

These findings support the integration of internal medicine specialists into the perioperative care pathway as standard practice for high-risk orthopedic surgical patients, even in resource-constrained settings like Bangladesh. The successful implementation of such a model at BSMMU—involving surgeons Dr. Moshiur Rahman, Dr. K M Rafiqul Islam, and Dr. Md. Ishtiaque Ahmed collaborating with internist Dr. Sharmin Chowdhury—suggests that it is feasible and effective in South Asian tertiary care contexts.

Acknowledgments

The authors acknowledge the contributions of the nursing staff, physical therapists, and administrative personnel at BSMMU who facilitated the implementation of the co-management program. We are grateful to all patients who participated in this study.

Funding: This study received no external funding.

Conflict of Interest: The authors declare no conflicts of interest.

Author Contributions:

- Dr. Moshiur Rahman: Conceptualization, methodology, data curation, writing - original draft
- Dr. K M Rafiqul Islam: Data collection, investigation, validation
- Dr. Md. Ishtiaque Ahmed: Data collection, investigation, formal analysis
- Dr. Sharmin Chowdhury: Conceptualization, methodology, supervision, writing - review & editing, corresponding author

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