## Non-Selective Enhanced Recovery Pathway in Primary Hip and Knee Arthroplasty: A Matched Cohort Comparative Analysis on Safety and Efficacy

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INTRODUCTION: Enhanced Recovery Pathways (ERPs) have been introduced in hip and knee arthroplasty to expedite recovery, shorten inpatient stay, and reduce costs. This study aims to investigate the safety and efficacy of implementing Non-Selective ERP in a single high volume tertiary centre. The pathway consisted of three main elements: pre-operative patient education, standardisation of peri-operative anaesthetic protocol, and encouragement of early mobilisation with a standardised physiotherapy protocol.

METHODS: All patients who underwent primary hip or knee arthroplasty under ERP from April 2023 to March 2024 were compared with a matched cohort between January 2018 and December 2019. This time period was chosen for the matched cohort to avoid bias in the comparison due to the impact of the COVID-19 pandemic on patients' length of stay, morbidity, and mortality during the period between 2020 and 2022. Patients were matched at a 2:1 ratio based on procedure, age, sex, ASA grade, and BMI (Enhanced recovery = 1811, Standard Care = 3549 patients). Outcomes included Length of Stay (LOS), 30-day readmission, overall infection, superficial infection, deep infection, 30- and 90-day mortality rates. Propensity score matching was performed using R software (R Core Team, 2020). Length of stay was compared using the Mann-Whitney U test. Categorical outcomes were compared using the chi-square test. Three separate subgroup analyses were conducted to compare length of stay and outcomes: 1) in patients aged  $\geq$  80 years, 2) in patients with ASA 3 and 4, and 3) in patients with a BMI  $\geq$  40. RESULTS:

Table 1 shows patients demographics and characteristics in the two groups. The median LOS was 1 day (IQR 1-2) in the ERP group versus 3 days (IQR 2-4) in the Standard Care group (W = 5415769, p < 0.001). Rates of readmission (1.7% vs. 2.1%), overall infection (0.66% vs. 1.15%), deep infection (0.39% vs. 0.68%), superficial infection (0.28% vs. 0.48%), 30-day mortality (0.11% vs. 0.20%), and 90-day mortality (0.22% vs. 0.37%) were all higher in the Standard Care group. However, these differences were not statistically significant, with p values of 0.41, 0.11, 0.26, 0.38, 0.70, and 0.52, respectively.

The subgroup analysis for patients  $\ge$  80 revealed a statistically significant difference in LOS, which was further pronounced with a median difference of 3 days (5 days in Standard Care vs. 2 days in ERP, *p*<0.001). The subgroup analysis for patients with ASA 3 and 4, as well as those with a BMI  $\ge$  40, demonstrated a median LOS difference of 2 days (1 day in ERP Vs. 3 days in standard care), aligning with the results observed in the entire group. Notably, there were no statistically significant differences observed in other outcome measures across all subgroup analyses. DISCUSSION AND CONCLUSION:

Non-Selective ERP was safe and effective in reducing LOS in primary hip and knee arthroplasty patients with ASA I through IV without significant changes in readmission, infection, or 30- and 90-day mortality rates.

Previous studies outlined the efficacy of ERPs in reducing patients LOS; however, these were patient-selected and mostly included those with ASA I, II or younger age groups. This study proved that the efficacy of ERP extends to the morbid and elderly patients. It also demonstrated the safety in implementing non-selective ERP across all patients undergoing primary hip and knee arthroplasty, regardless of age or medical condition.

The subgroup analysis showed a greater reduction in LOS in the  $\geq$ 80 years old group. The benefits of implementing ERP could extend beyond cost reduction, particularly for elderly patients with comorbidities. These patients are at risk of developing medical complications such as chest infections, acute kidney injury, and venous thromboembolism as a consequence of prolonged hospital stays. Encouraging early mobilisation and expediting rehabilitation for this group could further reduce medical complications. We believe this approach could pave the way for broader implementation of such pathways and expand inclusion to involve revision cases.

	Standard Care	Enhanced Recovery	P value	SMD
n	3549	1811		
Age (mean $\pm$ SD)	$67.36\pm10.99$	$67.64 \pm 10.78$	0.389	0.025
Sex (%)				
	Female: 51.8%	Female: 49.5%	0.111	0.047
	Male: 48.2%	Male: 50.5%		
$BMI$ (mean $\pm$ SD)	$30.48\pm5.67$	$30.65 \pm 5.42$	0.307	0.030
$ASA (mean \pm SD)$	$2.07\pm0.58$	$2.08\pm0.55$	0.480	0.021
Procedure (%)				
	Primary Hip: 45.8%	Primary Hip: 46.8%	0.107	0.049
	Primary Knee: 47.3%	Primary Knee: 51.3%		
	Uni Knee: 6.9%	Uni Knee: 1.9%		