CBC-Based Ratios Identify Patients Most Likely to Benefit From Perioperative Dexamethasone Following Total Joint Arthroplasty

Julian Wier MD[1], Ian A. Jones MD[2], Ryan Palmer BS[1], Nathanael D. Heckmann MD[1]
[1]Department of Orthopaedic Surgery, Keck School of Medicine of the University of Southern California, Los Angeles, California, [2]Department of Anaesthesiology & Pain Medicine, University of Washington, Seattle, Washington.
rcpalmer@usc.edu

Disclosures: Julian Wier (N), Ian A Jones (N), Ryan Palmer (N), Nathanael D. Heckmann (1: Corin U.S.A.; 3B: Intellijoint Surgical, MicroPort Orthopedics, Corin U.S.A, Zimmer; 4: Intellijoint Surgical; 9: AAOS, AJRR, AAHKS)

INTRODUCTION: Complete blood count based ratios (CBRs), including Neutrophil-Lymphocyte Ratio (NLR) and Monocyte-Lymphocyte Ratio (MLR), are inflammatory markers that have been associated with postoperative morbidity for a number of surgical indications. Given the well-established link between the surgical stress response and deleterious postoperative outcomes following total joint arthroplasty (TJA), this study aimed to understand whether the benefits of the anti-inflammatory medication dexamethasone are more pronounced in patients with higher CBR values.

METHODS: The Premier Healthcare Database was queried for adult patients who underwent primary, elective total knee arthroplasty (TKA) or total hip arthroplasty (THA). Primary endpoints were the odds of any 90-day postoperative complication and length of stay ≥3 days. Secondary outcomes were postoperative nausea and vomiting (PONV), pulmonary complications, and postoperative infection. Multivariable logistic regression models on study outcomes using dexamethasone exposure and CBC ratios as independent variables were developed to account for potential confounding factors. The difference in probability of study outcomes between the dexamethasone and non-dexamethasone groups was determined at each NLR and MLR level, and 95%-confidence intervals (CI) were generated for the absolute probability differences. Finally, dexamethasone exposure was compared across NLR and MLR quartiles as appropriate.

RESULTS: In this study, we identified 32,849 primary, elective TJAs from 2016-2021. In total, 22,282 (67.83%) received perioperative dexamethasone. Younger patients (65.88±10.4 vs. 66.85±10.2 years, $p<0.001$) and women (59.43%, $p<0.001$) were more likely to receive dexamethasone. Patients who received dexamethasone were hospitalized for 0.35 days less than those who did not (1.52±1.71 vs. 1.87±1.76 days, $p<0.001$). Patients who received dexamethasone trended towards fewer postoperative complications at higher NLR values compared to patients with lower CBR values. The reduction in odds of being admitted for ≥3 days conferred by dexamethasone exposure was significantly greater for patients presenting within the highest NLR quartile (>4.67) compared to those in the lowest (NLRs <1.84) ($p=0.002$). Patients with higher MLR values that were treated with dexamethasone experienced fewer postoperative complications than dexamethasone-treated patients with lower CBR values. Dexamethasone was similarly associated with a reduced likelihood of a protracted LOS when comparing patients with MLRs >0.330 (≥3rd quartile) to those in the first quartile (MLRs <0.239) ($p=0.039$).

DISCUSSION: In this study of elective TJAs, treatment with dexamethasone exhibited a general trend towards improved marginal benefits with increasing NLR and MRL. This held true for the primary outcomes of total postoperative complications and protracted length of stay, as well as the secondary outcomes of PONV and pulmonary complications. This study is among the first to show that CBRs can be used to identify patients most likely to benefit from a targeted intervention. Such a finding would be noteworthy for any biomarker; however, this is especially true in the case of CBRs because, unlike other markers of inflammation, CBRs are obtained from a routine hemogram with an automated differential and therefore are commonly available and functionally cost-neutral. That being said, the study does have several limitations, including its retrospective nature and that preoperative CBC with differential may not be the standard of care at all surgery centers.

SIGNIFICANCE/CLINICAL RELEVANCE: Treatment with dexamethasone exhibited an overall trend towards improved marginal benefits with increasing NLR and MRL. Given the immunomodulatory effect of dexamethasone, as well as the fact that marginal benefits were observed among patients with higher CBR values, the present study suggests a potentially targetable link between adverse outcomes and perioperative inflammation; additional work is needed to understand if and how these findings can be used to improve clinical outcomes and guide treatment decisions.