ASSOCIATION OF COMORBIDITIES, PRE-OPERATIVE ACTIVITY AND PRE-OPERATIVE PAIN WITH POST-OPERATIVE PAIN TRAJECTORIES FOLLOWING TOTAL KNEE ARTHROPLASTY

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INTRODUCTION:

Patient-reported pain following total knee arthroplasty (TKA) varies substantially between patients, influencing satisfaction and functional outcomes. However, the specific impact of pre-operative conditions on the trajectory for pain recovery remains less defined. Understanding these associations is critical for tailoring patient expectations and optimizing peri-operative care. This study sought to examine the combined influence of pre-operative pain levels and patient-reported comorbidities on post-operative pain recovery. The primary objective was to identify if distinct pre-operative patient profiles (pain, activity and health status) correlated with differential post-operative pain trajectories.

METHODS:

Following a waiver from an institutional review board (WCG IRB # 20222582) we performed a secondary analysis of an anonymized commercial database of 126,575 patients, populated via a digital care management platform. Patients in clinical studies or with multiple recorded procedures were excluded (n=12,783). The study cohort (n=26,754) included primary TKA patients who completed relevant pre-operative surveys, supplied objective gait metrics (days -30 to -10 pre-operatively via wearables and smartphones), and provided post-operative pain scores (0-10 numerical rating scale) up to 180 days post-operative. The median age was 67 years (IQR: 60 – 72), median BMI 30.3kg/m^2 (IQR, 26.5 – 35.1), and 58.1% were female. Comorbidities were collected prospectively from a past medical history survey within the platform (smoking tobacco, heart disease, stroke, anxiety/depression, diabetes, DVTs or pulmonary embolism, recent serious fall causing a limp, prior bone or joint surgery, or none). Cohorts were defined by individual pre-operative factors (activity levels, specific comorbidities) and combinations, such as pre-operative pain category (derived from -30 to -1-day median pain score) with activity level or comorbidities. Pain was categorized as “high” (score >7), “medium-high” (4< score ≤7), “medium-low” (2< score ≤4) and “low” (score ≤2). The difference in pain recovery trajectories was defined as the mean absolute difference in pain score between average pain trajectories during days 15-30 post-operative. Pre-operative steps and gait speed were categorized as high (≥50th percentile and low (<50th percentile).

RESULTS:

The comorbidity prevalence for smoking tobacco was 29.8%, heart disease 38.8%, stroke 3.3%, anxiety/depression 18.7%, diabetes 13.3%, DVTs or pulmonary embolism 4.6%, recent serious fall causing a limp 6.0%, and prior bone or joint surgery 47.9%. The distribution of patients with at least one comorbidity who reported high or med-high pain was greater than those with no comorbidities between days 15-30 post-operative (Figure 1). Pre-operative pain was the strongest individual indicator of pain days 15-30 post-operative, though not clinically meaningful alone (<2 difference in pain score). Combining pre-operative pain categories with individual comorbidities (stroke, diabetes, DVTs or pulmonary embolism, depression/anxiety, smoking tobacco, recent serious fall causing a limp, joint surgery, heart condition) or pre-operative steps yielded clinically significant pain score differences (2 - 3.25, p<0.001, Figure 2). Combining pre-operative pain categories with multiple comorbidities and pre-operative steps yielded even greater separation (4.5-point difference in pain score, p<0.001) between cohort extremes between 15-30 days (Figure 3).

DISCUSSION AND CONCLUSION:

Patient-reported pre-operative pain and comorbidities are significantly associated with distinct post-operative pain recovery trajectories following TKA. Combining these pre-operative factors, especially with pre-op pain status, allows for the identification of patient subgroups with even greater differences in their pain experience post-surgery. These findings suggest that incorporating comorbidity profiles with pre-operative functional data, and pain levels into patient assessment can enhance pre-operative expectation discussions and potentially guide the allocation of targeted post-operative pain management resources. Future research should focus on optimizing combinations of these pre-operative factors to develop robust predictive models for individual patient pain recovery after TKA, and the effect of pain intervention on recovery trajectories.

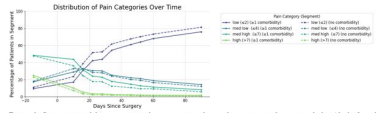

Figure 1: Comparison of the percentage of patient reported pain, for patients with no comorbidity (dashed) and those with at least 1 comorbidity (solid) by pain category.

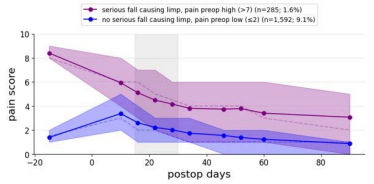

Figure 2: Pain recovery curves of the two most distant subgroups using attributes: pain pre-operative, recent serious fall causing a limp. The difference in pain recovery trajectory between groups was 3.25 during the 15-30 day period (p<0.001).

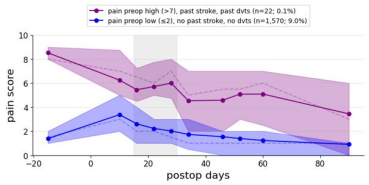

Figure 3: Pain recovery curves of the two most distant subgroups using attributes: pain pre-operative, stroke, DVTs. The difference in pain recovery trajectory between groups was 4.5 during the 15-30 day period (p<0.001).