Differential Outcomes of Total Knee Arthroplasty in Patients with Cluster A versus Cluster B versus Cluster C Personality Disorders

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INTRODUCTION: In the USA, the prevalence of personality disorders in the adult population is approximately 7%. Total Knee Arthroplasty (TKA) is an increasingly performed procedure, and patients with psychiatric comorbidities are over-represented among those undergoing TKA, with studies estimating the prevalence of psychiatric comorbidities in this cohort up to 30%. Patients with psychiatric comorbidities have a higher risk of medical and surgical complications following TKA, and they demonstrate poorer function and report higher pain levels following TKA regardless of surgical outcome. Certain personality traits, such as high neuroticism, low emotional stability, and somatization, as well as overall psychological distress and psychopathology, are particularly predictive of dissatisfaction and persistent pain. Personality disorders comprise behaviorally and biologically distinct Clusters A, B, and C, which may confer different risk profiles due to patient cluster-specific differences, and have not been reported previously. We compared each cluster of personality disorders to determine their risk of medical, infectious, wound, orthopedic, and opioid-related outcomes following total knee arthroplasty (TKA).

METHODS: The PearlDiver database was searched for patients who underwent TKA, and PD patients (n=2,691) were grouped into Cluster A (n=191), Cluster B (n=2,019), and Cluster C (n=481). Cluster A was 67.02% Female (n=128), 32.98% Male (n=63). Cluster B was 82.42% Female (n=1,664), 17.58% Male (n=355). Cluster C was 73.18% Female (n=352), 26.82% male (n=129). Demographic continuous variables were analyzed using independent t-tests and ANOVA, and categorical post-operative complications were compared using chi-square tests and multivariable logistic regression. Medical complications were Transfusion, Aspiration Pneumonitis, Shock, Nausea or Vomiting, Cardiac Arrest, Deep Vein Thrombosis, Pulmonary Embolism, Urinary Tract Infection, Acute Kidney Injury, and Pneumonia. Opioid-Related complications were Opioid Abuse and Opioid Use Milliliters of Morphine Equivalence (MME). Wound complications were Wound Disruption, Hematoma, Superficial Site Infection (SSI), and Deep Site Infection (DSI). Infectious complications were SSI, DSI, and Prosthetic Joint Infection (PJI). Orthopedic complications were Osteolysis, Loosening, Periprosthetic fracture, Other Mechanical Complications, Knee Instability, Knee Dislocation, Broken Implant, Surface Wear, PJI, Patella Instability, Extensor Mechanism Rupture, Ankylosis, Stiffness, Manipulation Under Anesthesia, and revision TKA.

RESULTS: When comparing the pooled outcomes of the three groups (Table 1), significant differences were observed in opioid abuse (P<0.001), opioid use MME (P<0.01), orthopedic complications (P<0.05), and all complications (P<0.05). When compared to Cluster A and C (Table 1), Cluster B was 2.33 times more likely to develop opioid abuse (P<0.001), greater opioid use MME (P<0.01), 1.37 times more likely to develop orthopedic complications (P<0.01), and 1.31 times more likely to develop all complications (P<0.01). Multivariate logistic regression analysis showed that Cluster B developed each pooled complication at the highest rate, but the difference was not significant (Table 2).

DISCUSSION: Cluster B had a significantly higher risk of opioid abuse, opioid use MME, orthopedic complications, and all complications. Although Cluster B continued to show higher risk of each pooled complication in the logistic regression, it was not statistically significant. While our study population is large, it may not represent the general population or show substantial rates of each complication and is likely underpowered in determining significant differences for rare complications. Nevertheless, the poorer outcomes and increased complication rates in Cluster B are supported by literature. Cluster B disorders are characterized by neuroticism, emotional dysregulation, impulsivity, and interpersonal difficulties, which negatively impact postoperative pain perception, satisfaction, adherence to rehabilitation, and healthcare utilization. These patients are more likely to have maladaptive coping strategies, pain catastrophizing, and poor engagement with postoperative care, leading to persistent pain and functional limitations. In contrast, Cluster A and Cluster C disorders, while associated with social withdrawal or anxiety, do not exhibit the same degree of emotional instability or impulsivity, and thus have less pronounced negative effects on TKA outcomes. Future studies may compare objective complications with patient-reported outcomes to better understand the impact of pain on post-operative complication rate and can expand on this study by using increased sample sizes in larger medical claims databases.

CLINICAL RELEVANCE: Surgeons should be informed about the worse outcomes of Cluster B patients when compared to other PD patients, especially relating to unique traits in Cluster B that cause increased pain perception and opioid use. This plays a role in determining the risk-benefit profile and efficacy of performing elective TKA in patients with PD, which may influence surgeons' decision-making capacity in selecting Cluster B patients as surgical candidates and may direct approaches on post-operative analgesia to improve patient-reported outcomes without contributing to opioid abuse.

Complication, n (%)	Cluster A (n=191)	Cluster B (n=2,019)	Cluster C (n=481)	P-value	Cluster B OR (95% CI)	P-value
All Medical Complications	28 (12.73%)	370 (16.44%)	77 (12.94%)	0.26	1.21 (0.96-1.54)	0.13
Opioid Abuse	12 (5.45%)	**336 (14.93%)**	41 (6.89%)	**<0.001**	2.33 (1.72-3.16)	**<0.001**
Opioid Use MME (Mean ± SD)	1537.49 ± 2185.64	**3273.17 ± 5821.71**	2702.66 ± 5600.00	**<0.01**	N/A	**<0.01**
All Wound Complications	6 (2.73%)	79 (3.51%)	13 (2.18%)	0.41	1.40 (0.84-2.33)	0.24
All Infections	16 (7.27%)	160 (7.11%)	23 (3.87%)	0.05	1.40 (0.97-2.01)	0.08
All Orthopedic Complications	39 (17.73%)	**548 (24.36%)**	105 (17.65%)	**<0.05**	1.37 (1.11-1.68)	**<0.01**
All Complications	65 (29.55%)	**824 (36.62%)**	167 (28.07%)	**<0.05**	1.31 (1.09-1.57)	**<0.01**

Table 1: Incidence of Complications. *OR: Odds Ratio, CI: Confidence Interval, SD: Standard Deviation

	Cluster A		Cluster B		Cluster C	
Outcome	**OR (Wald 95% CI)**	**P-value**	**OR (Wald 95% CI)**	**P-value**	**OR (Wald 95% CI)**	**P-value**
All Medical Complications	0.82 (0.53-1.25)	0.36	1.01 (0.79-1.30)	0.92	1.08 (0.81-1.43)	0.59
All Wound Complications	0.90 (0.38-2.10)	0.80	1.10 (0.65-1.87)	0.72	0.93 (0.51-1.72)	0.82
All Infections	1.06 (0.61-1.84)	0.84	1.28 (0.88-1.88)	0.20	0.68 (0.43-1.08)	0.10
All Orthopedic Complications	0.79 (0.55-1.15)	0.22	1.16 (0.94-1.45)	0.17	0.92 (0.72-1.17)	0.49
All Complications	0.83 (0.60-1.14)	0.24	1.10 (0.91-0.34)	0.34	0.97 (0.78-1.21)	0.80

Table 2: Multivariate Logistic Regression Analyzing the Odds of Developing Pooled Complications