Orthopaedic Nurse Navigators and Total Joint Arthroplasty Preoperative Optimization

Diabetes and Cardiovascular Disease—Part 3 of the Movement Is Life Special *ONJ* Series

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Diabetes and cardiovascular disease are some of the most common risk factors for complications after total joint arthroplasty (TJA). Preoperative optimization programs are dependent on nurse navigators for coordination of interventions that improve patients' health and surgical outcomes. This article uses information regarding the current practices for diabetes and cardiovascular disease management to provide recommendations for nurse navigators when managing these risk factors prior to TJA. We consulted nurse navigators and conducted a literature review to learn about strategies for addressing diabetes and cardiovascular disease in preoperative optimization programs. Nurse navigators can play a critical role in addressing these conditions by providing patient education and implementing preoperative optimization protocols that incorporate discussion regarding guidelines for diabetes and cardiovascular disease management prior to surgery. This article shares recommendations and resources for nurse navigators to help address diabetes and cardiovascular disease as part of preoperative optimization programs.

INTRODUCTION

This article is Part 3 of a series in the *Orthopaedic Nursing* Journal (*ONJ*) that explores the role of orthopaedic nurse navigators in preoperative optimization for total joint arthroplasty (TJA; see Figure 1). This article focuses on the management of diabetes and cardiovascular disease (CVD) and provides practical recommendations for optimizing these risk factors through preoperative optimization programs.

Prior research has demonstrated that diabetes and CVD are risk factors for suboptimal outcomes (Adie et al., 2019; Al-Otaibi, 2021; Marchant et al., 2009) and greater rates of discharge to nursing facilities or rehabilitation centers (Keswani et al., 2016) after TJA. Diabetes is associated with poor wound healing, increased 30-day readmission rates, increased surgical site infections, and increased overall complication rates (Boraiah et al., 2015; Harris et al., 2013; Yang et al., 2014). Diabetes is a common comorbidity in patients with elevated body mass index (BMI), which may necessitate coordinated management of both conditions in preoperative optimization programs to mitigate the suboptimal outcomes patients may experience (Changulani et al., 2008; Fournier et al., 2016; Wang et al., 2018). A history of CVD has been identified as one of the most significant risk factors for mortality and cardiac complications, such as myocardial infarction (MI) or cardiac arrest, within 30 days of TJA (Adie et al., 2019; Belmont et al., 2014). This article synthesizes information regarding current diabetes and CVD

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Orthopaedic Nurse Navigators and Preoperative Optimization: The Movement is Life Special ONJ Series – Context Statement
Patient comorbidities such as obesity, uncontrolled diabetes, and smoking are common and associated with increased postoperative complications among patients seeking TJA. In addition, social determinants of health, such as socioeconomic status or mental health conditions may contribute to postoperative health complications and can act as barriers to care. While many medical comorbidities and biopsychosocial factors affecting patients are modifiable conditions that can be addressed preoperatively and increasingly popular practices of patient optimization relying on orthopaedic nurse navigators for implementation may prove beneficial to both providers and patients, marginalized patient populations carry an increased comorbidity burden and are at increased risk of exclusion from TJA when eligibility criteria are used in these programs. Nurse navigators can assist in the development and implementation of these programs and thus improving both outcomes and equity of TJA while increasing the ability of patients with comorbidities and risk factors to safely receive treatment.

FIGURE 1. Context statement for orthopaedic nurse navigators and preoperative optimization series. TJA = total joint arthroplasty.

management practices to provide recommendations for nurse navigators to use when managing these risk factors prior to TJA.

METHODS

NURSE NAVIGATOR PERSPECTIVES

The introduction to this article series describes the full methodology (Kebeh et al., 2023b). We utilized an online forum to contact 25 nurse navigators across the United States who were members of the National Association of Orthopaedic Nurses (NAON). Over the phone or via videoconference, we recorded semistructured discussions regarding their approach to managing diabetes and CVD among patients seeking TJA. Four initial standard questions (see Figure 2) were followed by open-ended questions about referral to resources, patient education, and the nurse navigator's role in optimization. Because of the open-ended nature of these discussions, each featured unique content.

LITERATURE REVIEW

We selected the Scopus and Web of Science databases to conduct a literature review that would capture a variety of journal and article types across disciplines and fields of study. This yielded 18 articles relevant to diabetes and nine articles relevant to CVD.

RESULTS

DIABETES

Nurse Navigator Perspectives

Nurse navigators described several strategies and resources for diabetes management (see Table 1). Ninety-six percent of nurse navigators stated that a member of

Question 1	Questions 2 and 3	Question 4
• Describe your role as a nurse navigator and how you interface with patients throughout the preoperative optimization process.	• Is [smoking status, alcohol use, opioid use, diabetes, cardiovascular disease, obesity, malnutrition, mental health, housing, payer status and affordability, or medication management] an area that is addressed as part of preoperative optimization at your institution? • If so, how is this risk factor managed or optimized? What is your role in its optimization?	• Please share any additional resources you use to remain apprised of current guidelines and preoperative optimization strategies for TJA.

FIGURE 2. Standard questions asked of orthopaedic nurse navigators. TJA = total joint arthroplasty.

TABLE 1. INTERVENTIONS FOR DIABETES REPORTED BY NURSE NAVIGATORS

- Education in joint class and via virtual education modules and motivation (delivered by online or app-based education platforms)
- Referral to dietitian
- Referral to diabetes management program through surgeon, PCP, or endocrinologist
- Referral to community intervention programs

Note. PCP = primary care provider. Interventions in **bold** can be implemented in-house (without referrals or outside resources).

TABLE 2. INTERVENTIONS FOR CARDIOVASCULAR DISEASE REPORTED BY NURSE NAVIGATORS

- Referral to cardiology or PCP
- Coordination with cardiology to expedite wait time for appointment
- Referral to care coordinator

Note. PCP = primary care provider.

the surgical care team discussed diabetes with patients who had this diagnosis preoperatively. Twenty percent of nurse navigators stated that discussions or interventions to address diabetes were conducted by the surgeon or surgical preadmission testing (PAT) unit before the navigator's initial interaction with the patient. As a result, some nurse navigators were unaware of what measures may have been taken to help patients manage their diabetes or did not have a role in optimizing this area.

Hemoglobin A_{1c} (HbA_{1c}) values often played a role in determining patients' current candidacy for TJA, with 92% of nurse navigators reporting that specific cutoff values, above which patients were not considered current candidates for surgery, were used at their institutions. These values ranged from an HbA_{1c} of 7% to 8.5%. Eight percent of nurse navigators reported that they were not aware of a specific institution-wide HbA_{1c} cutoff threshold, and individual surgeons determined their own cutoffs. Among the institution-wide cutoff thresholds reported, HbA_{1c} above 8% was the most common, with 48% of nurse navigators stating that their institution used this value. Twenty-four percent of nurse navigators reported cutoff thresholds of HbA_{1c} above 7.5%. Thresholds were also used to initiate referral to endocrinology or consultation with the patient's primary care provider (PCP).

Nurse navigators described several strategies and resources for diabetes management, including universal patient education regarding the impact of diabetes on postoperative outcomes through joint classes or online patient education platforms, referral to dietitians, and referral to diabetes clinics or intervention programs that provided education, medical management, continuous glucose monitoring, and exercise strategies (see Table 1). Those nurse navigators who had multiple contacts with patients prior to TJA utilized subsequent contacts to follow up on patients' ability to access and benefit from these strategies and resources.

Literature Review

Diabetes is commonly identified as a risk factor that is associated with increased overall complication rates and worse outcomes after TJA (Ahn et al., 2019; Al-Otaibi, 2021; Boraiah et al., 2015; Harris et al., 2013; Marchant et al., 2009; Yang et al., 2014). Management of diabetes has been described as an important aspect of patient optimization protocols, with multiple institutions recommending diabetes management in preoperative optimization programs that have demonstrated outcomes such as decreased infection and mortality rates (Adie et al., 2019; Bozic et al., 2012; Marchant et al., 2009; Wang et al., 2018). In our literature search, we found that HbA_{1c} cutoff values for surgical eligibility or delay ranged from 6.5% to 8% (Cross et al., 2014; Dlott et al., 2020; Gottschalk et al., 2014; Johns et al., 2020; Morrell et al., 2019; Nussenbaum et al., 2018). Recommendations for management of diabetes included referral to a PCP or endocrinologist for patients with HbA_{1c} values above 7%–8% (Bullock et al., 2017; Dlott et al., 2020; Featherall et al., 2018) or other signs of uncontrolled diabetes such as peripheral vascular disease or coronary artery disease (CAD; Adie et al., 2019), consideration of bariatric surgery before TJA (Fournier et al., 2016), blood glucose checks on the morning of surgery with a potential delay of TJA for measured values above 200 mg/dl (Featherall et al., 2018), and routine postoperative consultation from internal medicine for all patients with diabetes (Gottschalk et al., 2014).

CARDIOVASCULAR DISEASE

Nurse Navigator Perspectives

Ninety-six percent of nurse navigators reported that CVD was discussed with patients prior to TJA, though these discussions often took place with the surgeon or PAT team. As a result, 28% of nurse navigators reported that they were not involved in the optimization of patients' cardiovascular health. Interventions for assessment and management of CVD by nurse navigators who were involved were based on multiple factors such as patient comorbidities, surgeon and patient preference, and a history of CVD or procedures. Interventions typically involved referrals to outside resources (see Table 2).

Forty-four percent of nurse navigators mentioned referral to cardiology or the patient's PCP as an intervention for optimization of cardiovascular health. Sixteen percent of nurse navigators indicated that they may communicate with a patient's cardiologist to express the importance of the patient receiving care before TJA and advocate for a shorter wait time for an appointment, as this was a common concern among patients. Referral to a cardiovascular care coordinator was reported by 4% of nurse navigators.

Literature Review

Cardiovascular events are among the most frequent postoperative complications following TJA (Elsiwy et al., 2020; Featherall et al., 2018). Cardiovascular health is also closely tied to other independent risk

factors such as obesity and uncontrolled diabetes (Featherall et al., 2018; Fournier et al., 2016), which may predispose patients to CVD. One study found that older men and patients with more medical comorbidities have a greater risk of acute MI after TJA (Menendez et al., 2015). The interventions described for optimization of cardiovascular health as part of preoperative optimization protocols that demonstrated decreased length of stay and postoperative emergency department visits included referral to cardiology (Adie et al., 2019; Dlott et al., 2020; Featherall et al., 2018), appraisal of cardiopulmonary function in preoperative assessments (Adie et al., 2019), incorporation of preoperative rehabilitation training (Adie et al., 2019; Wall & de Steiger, 2020), and increased perioperative cardiac monitoring and management for those at risk for CVD (Belmont et al., 2014). Adherence to guidelines for the assessment and management of surgical patients with established or underlying CVD was recommended, including postponement of elective surgery until conclusion of a course of dual antiplatelet therapy following coronary stent placement, continuation of aspirin through elective surgery episodes when possible, and aortic valve replacement for aortic stenosis prior to elective surgery (Adie et al., 2019; Kristensen et al., 2014).

DISCUSSION

The prevalence of diabetes and concern for CVD among patients seeking TJA highlight the importance of screening for these risk factors as part of preoperative optimization protocols (Adie et al., 2019; Al-Otaibi,

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TABLE 3. RESOURCES FOR IMPLEMENTING RECOMMENDATIONS: DIABETES AND CARDIOVASCULAR DISEASE

Resources
• Lifestyle Change Programs for patients with program locator (ADA, 2022a)
• Diabetes Education Program locator (ADA, 2022b)
• Healthy Living patient resources (ADA, 2022c)
• Diabetic diet meal planning and grocery lists (ADA, 2022d)
• Events and support groups (ADA, 2022e)
• American Diabetes Association Standards of Care slide deck (ADA, 2022f)
• Patient education website with learning modules (American Academy of Orthopaedic Surgeons, 2021)
• Advocacy and education toolkits (American Academy of Orthopaedic Surgeons, 2022)
• Articles and printable handouts for patients on preparing for surgery, including blood sugar control (American College of Surgeons, 2022)
• Podcasts on orthopaedic surgery, nursing, care coordination, and risk factors (Becker's Healthcare, 2022a)
• Webinars on orthopaedic surgery, nursing, care coordination, and risk factors (Becker's Healthcare, 2022b)
• SAMHSA substance use cessation resources (SAMHSA, n.d.)

Note. ADA = American Diabetes Association; SAMHSA = Substance Use and Mental Health Services Administration.

2021). Increased ability to optimize patients' control of their diabetes and cardiovascular health can decrease surgical risks and improve outcomes for many TJA patients. These improvements may be especially important for patients from minority backgrounds, as they have been demonstrated to have worse outcomes following TJA (Dlott & Wiznia, 2022) and face greater comorbidity burdens, which are associated with poor postoperative cardiovascular outcomes (Menendez et al., 2015). Studies have indicated that TJA patients with HbA_{1c} of 7% or more were more likely to be African American and need medications for diabetes management (Harris et al., 2013), making diabetes an important factor to address preoperatively among the African American patient population seeking TJA.

Our discussions with nurse navigators indicated that they were less involved in the optimization of diabetes management and cardiovascular health, two highly specialized areas of care, than in some other areas of preoperative optimization (Kebeh et al., 2023a). However, nurse navigators have the potential to play a critical role in the ability of patients to connect to educational and supportive resources for the management of these risk factors. To facilitate this, we provide resources for nurse navigators to use when optimizing these risk factors (see Table 3).

RECOMMENDATIONS—DIABETES

We have developed recommendations to assist nurse navigators with diabetes management (see Table 4). We strongly recommend that nurse navigators maintain awareness of PAT protocols and discuss the inclusion of blood glucose and HbA_{1c} measurements with surgeons and medical directors, including for patients who are overweight but do not have an established diabetes diagnosis (Wiznia, Jimenez, et al., 2022). Care teams should work with patients to achieve goals in HbA_{1c} reduction rather than imposing strict cutoffs, and nurse navigators should help keep patients oriented toward these goals. Given that strict cutoffs can disadvantage vulnerable patient populations from accessing TJA (Chun et al., 2021) and an HbA_{1c} value of less than 7 may be unattainable for some patients (Giori et al., 2014; Harris et al., 2013), we recommend that nurse navigators collaborate with the patient and their PCP to achieve the safest HbA_{1c} value for each individual rather than broadly applying strict cutoffs. For patients with comorbid diabetes and patients who are overweight or with obesity, nurse navigators should also be aware of the recommendations of the American Society for Metabolic and Bariatric Surgery regarding weight loss medications such as glucagon-like protein-1 (GLP-1) agonists. A trial of these medications is recommended prior to weight loss surgery among patients who are overweight (BMI = 25–29.9 kg/m²) or with Class I obesity (BMI = 30–34.9 kg/m²) (Eisenberg et al., 2022).

Although nurse navigators are not always directly implementing protocols for diabetes management, they should coordinate with surgeons, endocrinologists, PCPs, or diabetes management programs to support patients in receiving specialist care. We recommend nurse navigators use joint class presentations and asynchronous online or app-based patient education

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TABLE 4. RECOMMENDATIONS FOR PREOPERATIVE OPTIMIZATION: DIABETES

Diabetes
• Advocate for inclusion of diabetes assessment and management through preadmission testing of blood glucose and HbA$_{1c}$ for patients who are overweight or have established diabetes
• Advocate for shared decision-making to determine target HbA$_{1c}$
• Encourage surgeon to make standardized referral to and communication with endocrinologist, PCP, or diabetes management program for medication management, exercise and lifestyle modification, substance use cessation planning, and diet planning
• Incorporate patient education on effects of uncontrolled diabetes and lifestyle modification including ketogenic or diabetic diet meal planning into joint classes, individual counseling, and online education platforms
• Encourage surgeon to recommend continuous blood glucose monitoring to reach HbA$_{1c}$ goals
• Discuss guidelines for discontinuation of metformin (on the day of) and SGLT-2 inhibitors (3–4 days prior to) TJA with the endocrinologist or PCP
• Encourage surgeon collaboration with internal medicine providers throughout admission to manage blood glucose level

Note. HbA$_{1c}$ = hemoglobin A$_{1c}$; PCP = primary care provider; SGLT-2 = sodium-glucose cotransporter-2; TJA = total joint arthroplasty.

platforms such as Wellbe, CareSense, HealthLoop, or Care Companion to provide evidence-based education regarding the surgical risks accompanying uncontrolled diabetes, such as increased risk of wound infection (Harris et al., 2013; Yang et al., 2014), share information about diabetes support groups or the American Diabetes Association's (ADA's) education programs, and describe strategies for lifestyle changes such as alcohol cessation or routine exercise when counseling patients. Nurse navigators can share the Substance Abuse and Mental Health Services Administration (SAMHSA) website or hotline to provide patients with resources for smoking and alcohol cessation (SAMHSA, n.d.). Nurse navigators should collaborate with nutritionists, dietitians, and PCPs to share information from these providers about meal planning and following diabetic or ketogenic diets. In addition, nurse navigators should be aware of potential comorbidities affecting diet and exercise ability such as CVD and collaborate with PCPs or physical therapists when supporting patients in making lifestyle changes. Because these lifestyle interventions can benefit a majority of patients seeking TJA, they should be discussed universally in joint classes. Digital resources should be utilized in addition to joint classes rather than as a replacement, as some TJA patients may be unable to access the internet or successfully utilize these resources (Mamedova & Pawlowski, 2018).

Nurse navigators should encourage surgeons to recommend that patients use continuous glucose monitoring so that they are better able to track their blood glucose levels as they work to attain preoperative HbA$_{1c}$

goals. Nurse navigators should be aware of guidelines regarding perioperative management of diabetes medications so that they can discuss management strategies provided by the patient's PCP or endocrinologist. For example, guidelines indicate that patients should not take metformin on the day of surgery or sodium-glucose cotransporter-2 (SGLT-2) inhibitors in the 3–4 days prior to TJA (ADA, 2021; Himes et al., 2020; Wiznia, Jimenez, et al., 2022). Perioperative measures of blood glucose should remain below 200 mg/dl (Gottschalk et al., 2014). If using Enhanced Recovery After Surgery (ERAS) protocols, perioperative carbohydrate loading should be adjusted for patients with diabetes. Patients with diabetes should also receive consultation with internal medicine providers to monitor their blood glucose levels in the perioperative period and told to follow up with their PCP or endocrinologist 1–3 weeks after TJA (Featherall et al., 2018; Wiznia, Jimenez, et al., 2022). Although nurse navigators are not prescribing medications or deciding which management interventions are to be implemented, background knowledge can be utilized to more effectively collaborate with patient care providers who are making these decisions.

RECOMMENDATIONS—CARDIOVASCULAR DISEASE

We recommend that nurse navigators advocate for the consideration of CVD in preoperative optimization protocols at their institutions and have developed recommendations for managing patients with CVD-related risks (see Table 5). Although this is another area that may require specialized intervention from other providers, we recommend nurse navigators offer education and support to patients by incorporating information about cardiovascular health and CVD-related risks into joint classes, such as the association between a history of CVD and the postoperative increased risk of a major cardiac event (Belmont et al., 2014). In addition, we recommend nurse navigators help patients address difficulties with receiving specialty care through advocacy for expedited cardiology appointment scheduling and referral to a care coordinator when available.

Patients with CVD will likely have questions related to medication regimens and uncertainty about how they should adjust these regimens prior to TJA. Current guidelines that nurse navigators should be familiar with and be prepared to discuss with PCPs and cardiologists include that hypertension medications such as β-blockers, angiotensin II receptor blockers (ARBs), and angiotensin-converting enzyme (ACE) inhibitors can be continued perioperatively, as can statins or aspirin taken for cardiac protection (American College of Surgeons, 2017; Fleisher et al., 2014; Wiznia, Santos, et al., 2022). In addition, continuation of anticoagulants and nonsteroidal anti-inflammatory agents in the 2 weeks prior to TJA should be discussed with the patient's PCP or cardiologist (American College of Surgeons, 2017; Fleisher et al., 2014). Although the patient's PCP or cardiologist will be making these decisions, knowledge of these recommendations can improve communication and coordination with the patient's other providers and allow the nurse navigator to better support the patient.

Cardiovascular Disease

- Provide cardiovascular health education in joint classes, including diet and exercise regimen examples
- Advocate for expedited appointment scheduling with cardiology or referral to care coordinator
- Discuss guidelines for continuation of hypertension medications with cardiologist or PCP, including β-blockers, ARBs, ACE inhibitors
- Discuss guidelines for continuation of cardioprotective medications with the cardiologist or PCP, including statins and aspirin
- Discuss guidelines for continuation of anticoagulation and NSAIDs with the cardiologist or PCP
- Discuss guidelines for consideration of assessment of functional capacity in PAT and with the cardiologist through exercise testing for patients with elevated cardiac risk and/or unknown functional capacity
- Discuss guidelines for consideration of ECG in PAT for patients with a history of CVD, arrhythmias, or PVD with the cardiologist or PCP
- Discuss guidelines for TJA postponement in patients with MI history in the last 3–6 months, cardiovascular intervention in the last 6 months, or unstable CHF with cardiologist, PCP, or surgeon

Note. ACE = angiotensin-converting enzyme; ARB = angiotensin II receptor blocker; CHF = congestive heart failure; CVD = cardiovascular disease; ECG = electrocardiograph; MI = myocardial infarction; NSAID = nonsteroidal anti-inflammatory drug; PAT = preadmission testing; PCP = primary care provider; PVD = peripheral vascular disease; TJA = total joint arthroplasty.

Patients with CVD can benefit from lifestyle modifications. We recommend nurse navigators support patient efforts to achieve weight loss, follow meal plans such as diabetic or ketogenic diets, and adopt low-impact exercise routines as recommended by the patient's PCP or cardiologist. This may require exercise testing of cardiopulmonary function and interpretation by a cardiologist to determine safe and effective forms of exercise for patients. Exercise testing should be performed at the discretion of the patient's PCP or cardiologist for patients with elevated cardiac risk due to CAD, arrhythmias, congestive heart failure (CHF), or other CVD (Fleisher et al., 2014). Cessation of smoking and alcohol use is an important intervention for patients with CVD. Nurse navigators should remain aware of these potential interventions so that they can suggest them for consideration by the patient's PCP or cardiologist for patients with ongoing CVD, a history of CVD, or elevated risk for CVD.

For patients with a history of CVD, arrhythmias, or peripheral vascular disease, nurses should be aware that there is a moderate level of evidence for conducting a 12-lead electrocardiogram during PAT and cardiologists may recommend this (Fleisher et al., 2014). There is also evidence that patients should not undergo TJA within 3–6 months of an MI and should receive approval from a cardiologist before proceeding with TJA after this period (Fleisher et al., 2014). Patients with a recent cardiovascular intervention should postpone TJA according to the corresponding recommendations of the American College of Cardiology and the American Heart Association. For example, patients should not receive TJA within 6 months of a stent placement (Fleisher et al., 2014). In addition, patients with CHF should prioritize working with a cardiologist and their PCP to stabilize their condition before considering TJA (Fleisher et al., 2014). Nurse navigators should note these findings in the literature regarding CVD management so that they can raise these concerns in support of shared decision-making, patient education, and appropriate management decisions by the surgeon, PCP, and cardiologist prior to surgery.

CONCLUSION

Preoperative optimization programs are dependent on nurse navigators for implementation and/or coordination of interventions that improve patients' overall health status and TJA outcomes. The information gathered from our discussions with nurse navigators and literature review has yielded practical recommendations regarding strategies for optimization of diabetes management and cardiovascular health.

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