Spring 5-1-2020

Optimal Blood Glucose Management and Effect on Patient Outcomes

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A Discussion of Post-operative Complications in Morbidly Obese Patients Following a Total Knee Arthroplasty

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A DISCUSSION OF POST-OPERATIVE COMPLICATIONS IN MORBIDLY OBESE PATIENTS FOLLOWING A KNEE REPLACEMENT

PERMISSION

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Department Nursing

Degree Master of Science

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A DISCUSSION OF POST-OPERATIVE COMPLICATIONS IN MORBIDLY OBESE PATIENTS FOLLOWING A KNEE REPLACEMENT

Abstract

Obesity is a risk factor for osteoarthritis, and as the number of morbidly obese patients is increasing so are the rates of total knee arthroplasty. As the incidence of morbidly obese patients undergoing total knee arthroplasty increases is important to determine what risks these patients may encounter (D'Apuzzo et al., 2015). This allows clinicians to educate patients on risks versus benefits of a total knee arthroplasty.

A literature review was compiled to examine post-operative complications in morbidly obese patients following a total knee arthroplasty. The literature review clearly demonstrated that infection, wound dehiscence, revision, and readmission were all complications. There was mixed evidence regarding the increased risk of myocardial infarct, pulmonary embolism, and deep vein thrombosis. There was also mixed evidence at what an ideal BMI should be to perform a total knee arthroplasty.

Recommendations included shared decision making and educating morbidly patients regarding post-operative complications. Additional research is needed in the area of prevention of post-operative infections in this population. Another area of more research should be an optimal BMI for surgery as well whether here should be an optimal BMI for operation.

The case report was part of an Observed Clinical Simulation Exam with oversight from a clinical faculty member. The patient discussed in the case report is a pre-operative exam for a morbidly obese 57-year-old female who was scheduled for a total knee arthroplasty. She also had a history of diabetes mellitus type 2, hypertension, and chronic kidney disease stage III. Based on a Revised Cardiac Risk Index and Ariscat score that patient was a low risk for cardiac and pulmonary complications. Complications and risks in the morbidly pre-operative patient will be discussed in this paper.

Background

Obesity is defined as a body mass index (BMI) of >30 kg/m^2. A normal, healthy BMI is considered to be between 18.5 kg/m^2 and 24.9 kg/m^2. A BMI between 25 kg/m^2 and 29.9 kg/m^2 is considered overweight. Morbid obesity is defined as a BMI > 40 kg/m^2 (George et al., 2018) The number of patients that are morbidly obese in the United States is increasing. Obesity itself has been associated with knee osteoarthritis (Napier et al., 2014). Knee osteoarthritis is a leading cause of disability in the adult population (Hakim et al., 2020). Because obesity is a risk factor for osteoarthritis and there is an increasing number of morbidly obese patient this leads to obese patients representing a higher proportion of patients that undergo a total knee arthroplasty (Meller et al., 2016; Napier et al., 2014). "The prevalence of obesity in patients undergoing TKA is 20% at the national level" (D'Apuzzo et al., 2015, p. 58). It is important to be aware of increasing statistics as obesity and especially morbid obesity are risk factors for post-operative complications and poor outcomes (D'Apuzzo et al., 2015). Looking at morbid obesity as a risk factor for complications is important, because morbidly obese patients undergoing total knee operations are more likely to have longer hospital stays and a higher total cost (D'Apuzzo et al., 2015).

The patient discussed in this case study is a morbidly obese 57-year-old female. Her BMI is 53.23 kg/m^2. She presented to the clinic for a pre-operative exam for a right knee replacement. She had previously had her left knee replaced. The patient was a low risk surgical patient for cardiac or respiratory complications based on a Revised Cardiac Risk Index and Ariscat score.

However, studies have shown that morbidly obese patients have increased risk of postoperative complications. A literature review was conducted to look at post-operative complications in morbidly obsess patients following a total knee arthroplasty.

Case Report

History of Present Illness: Patient is a 57-year-old female. She comes to the clinic for a pre-operative exam for a right knee replacement. Patient has a left knee replacement done within the past year. She continues to have pain of the right knee. Surgery is scheduled for 3/4/20 at Sanford in Fargo, ND. Patient denies any history of coagulation disorder, DVT, PE, adverse reactions to anesthesia. Patient during current wheezing, edema, shortness of breath or recent URI. Patient denies a family history of CVA, MI, coagulation disorder, or adverse reaction to anesthesia.

Current Medications: diclofenac sodium (VOLTAREN) 75 mg delayed-release (enteric coated) tablet Take 1 tablet (75 mg) by mouth 2 times a day, liraglutide (VICTOZA) 18 mg/3 mL subcutaneous injection solution (pen) Inject 1.8 mg subcutaneously 1 time per day, fluticasone (FLONASE) 50 mcg/spray nasal spray 1 spray into each nostril 1 time per day, insulin needle (BD PEN NEEDLE NANO U/F) 32G X 4 mm Use once daily as directed 100 each 3, metFORMIN (GLUCOPHAGE XR) 500 mg extended release tablet take four tablets by mouth every day, acetaminophen (TYLENOL) 500 mg tablet Take 1,000 mg by mouth Every 4 hours as needed (do NOT exceed 4000mg/ 24 hours including all sources), vitamin C, ascorbic acid, 500 MG tablet Take 1,000 mg by mouth 1 time per day, milk thistle-turmeric (SILYMARIN) CAPS capsule Take 1 capsule by mouth 1 time per day, glipiZIDE ER (GLIPIZIDE XL) 10 mg extended release tablet (24 hr) Take 1 tablet (10 mg) by mouth 1 time per day, hydroCHLOROthiazide 25 mg tablet Take 1 tablet (25 mg) by mouth 1 time per day, lovastatin (MEVACOR) 10 mg tablet Take 1 tablet (10 mg) by mouth 1 time per day, benazepril (LOTENSIN) 40 mg tablet Take 1 tablet (40 mg) by mouth 1 time per day, Multiple Vitamins-Minerals (ZINC PO) Take 1 tablet by mouth 1 time per day, blood glucose test strip

(ONETOUCH VERIO) 1 Strip 1 time per day, lancets (ONETOUCH DELICA) 1 each 1 time per day, Specialty Vitamins Products (ECHINACEA C COMPLETE PO) Take 1 tablet by mouth 1 time per day, CINNAMON PO Take 1 capsule by mouth 1 time per day

Allergies: amlodipine, environmental (hay fever), cats

Past Medical and Surgical History: severe obesity, OSA, neuroma of foot, primary hypertension, uncontrolled diabetes mellitus type 2, CKD stage 3, hypercholesterolemia, osteoarthritis of bilateral knees, left knee replacement in 2018

Family History: COPD (brother, unsure of age at diagnosis), diabetes mellitus (mother, unsure of age of diagnosis). Denies family history of sudden cardiac death, bleeding or clotting disorders, stroke, MI.

Social History: Patient is married and has two children. She works full time with MN tourism. She denies tobacco or illegal drug use. She reports having two drinks of alcohol a week. Patient reports it is hard for her to lose weight due to the inability to increase physical activity because of the pain in her knee.

Review of Systems:

Constitutional: Denies fevers, chills, fatigue.

Respiratory: Denies shortness of breath, cough, wheezing.

Cardiac: Denies chest pain, edema, palpitations.

Musculoskeletal: Reports right knee pain.

Physical Examination:

Vital Signs: BP: 136/90 P: 88 Weight: 371 lb BMI: 53.23

Constitutional: Well appearing obese 57-year-old female in no acute distress

ENT: Bilateral TM intact with no erythema or bulging. Oropharynx free from edema, exudate, or erythema.

Cardiac: S1 and S2 were heard. No murmur noted. Regular rate and rhythm. No peripheral edema in lower extremities. +2 pedal pulses.

Respiratory: Lung sounds clear bilaterally. Nonlabored respirations.

GI: Abdomen is soft, obese and nontender.

MSK: Right knee has full range of motion. No joint instability.

Management Plan:

1. Stage 3 Chronic Kidney Disease
    a. Check CBC and CMP
    b. Refer to nephrology
    c. Discontinue NSAIDS
2. Uncontrolled Diabetes mellitus type 2
    a. Check Hgb A1C, CBC, CMP
    b. Encouraged diet and exercise
    c. Recheck Hgb AIC in 3 months
3. Osteoarthritis
    a. Tylenol for pain
    b. Discontinue NSAIDS
4. Obesity
    a. Increase physical activity
    b. Encourage a healthy diet
    c. Refer to dietician

Discussed concerns regarding increased creatinine and BUN and decreasing GFR. Creatinine is 1.57 today and BUN is 21 and GFR is 46. Serum glucose is also elevated at 229 and the patient's Hgb A1C is 7.9. EKG and CBC and the other CMP results were within normal limits. Recommend patient should see nephrology regarding these changes. Discussed with patients the risk of NSAIDS with CKD. Discontinue NSAIDS and use Tylenol for pain relief instead. Encouraged patient to increase activity level and eating a healthy diet to help manage diabetes mellitus as well as help with weight loss. Patient was concerned that she will not be able to increase activity level due to knee pain. Revised Cardiac Risk Index calculated to be Class I risk. Ariscat score was low risk for this patient. Discussed with patient that she was at a low risk for cardiac and pulmonary complications related to surgery.

Literature Review

A literature review was completed to examine the evidence of post-operative complications following a total knee arthroplasty in morbidly obese patients. Obesity is a risk factor for osteoarthritis, and patients undergoing total knee arthroplasty are often obese. It is important to understand the risks of post-operative complications in morbidly obese patients so that education can then be provided to this population. A discussion regarding post-operative complications must occur so the patient is aware that they may be at increased risk for several complications. This discussion should also include measures to reduce the risk prior to surgery. Morbidly obese patients may have higher incidences of complications compared to patients that are obese (BMI >30kg/m^2 and <40kg/m^2) as well as patients that are not obese (Geroge et al., 2018).

Infection and Wound Dehiscence

Infections can occur in the wound or deeper around the artificial joint following a joint replacement. Due to the surgical incision there is a break in the skin's integrity, which allows bacteria to enter the body. Signs of an infection include fever, chills, erythema around the surgical site and exudative drainage of the incision (American Academy of Orthopedic Surgeons, 2018). Another wound complication is wound dehiscence. This is a severe post-operative complication and occurs wound breaks open along the sutures (Sazegari et al., 2017). In a literature review by Boyce et al. (2019) all the studies that were evaluated showed that superficial wound infection, periprosthetic joint infection, and delayed wound healing rates were increased in morbidly obese patients. Another literature review done by Sun & Li (2017) that also showed that infection was a complication that was increased in morbidly obese patients compared to patients with a normal BMI.

Wound dehiscence is another common complication with elevated risk in morbidly obese patients compared to nonobese patients (George et al., 2018; Meller et al., 2016). Rates of wound dehiscence increased linearly with increasing BMI (George et al., 2018). Patient's with morbid obesity were also found have an increased risk of wound dehiscence specifically while they are still in the hospital in a study by D'Apuzzo et al. (2015). This is demonstrated by a percentage of 0.11% of morbidly obese patients have wound dehiscence that occurs postoperative while in the hospital versus 0.08% of nonobese patients (D'Appuzo et al., 2015).

Infections rates post-operative is also higher in morbidly obese patients (Si et al., 2017). Deep infections are even more common in morbidly obese patients (Si et al., 2017). These included superficial infections and deep tissue infections were higher in morbid obesity compared to obese and nonobese patients (George et al., 2018; Hakim et al., 2020). Both

superficial and deep infection rates increase as the BMI increases (Si et al., 2015). There was a large study done by Adhikary et al. (2016) of 77,785 patients undergoing a unilateral total knee arthroplasty. The population was gathered from the American College of Surgeons NSQIP between 2006 and 2013 (Adhikary et al., 2016). This number of patients included patients with varying BMI. They were divided into group based on their BMI. This study showed that there was little difference in odds ratio for infection between patients that were nonobese (BMI between 18.5 kg/m^2 and 24.9 kg/m^2) and obese patients with a BMI of <45 kg/m^2 for several complications, including infection. However after a BMI of 45 kg/m^2 there was a significant difference in odds ratio and the odds of having a post-operative infection in the morbidly obese with a BMI of > 45 kg/m^2 was almost twice as high as a nonobese patient following a total knee arthroplasty (Adhikary et al., 2016). This is an important study for determining optimal BMI in the future to help reduce the rates of post-operative infections. D' Apuzzo et al. (2015) also found that postoperative infections while hospitalized was also increased in patients that had morbid obesity. In this study 0.24% of the morbidly obese patients had a postoperative infection versus 0.17% of non-obese patients (D'Apuzzo et al., 2015). This study by D'Apuzzo et al. (2015) did compare morbidly obese patients with nonobese patients based on their comorbidities.

Reasons for wound infection and delayed healing in morbid obesity can be due to decreased oxygenation of subcutaneous fat and a weakened immune system in the morbidly obese patient (Boyce et al., 2019). The number of monocytes and macrophages in obese patients is decreased. Lymphocyte migration inhibiting factor release is impaired in insulin resistant obese patients with normal blood sugars (Boyce et al., 2019). Compromised wound healing can also occur in morbidly obese patients due to increase fat deposition around the knee, which can make closure of the surgical wound more difficult (George et al., 2018). Fluid can collect in this

area which can impair wound healing (Martin, Jennings & Dennis, 2017). Currently there are no studies looking at how post-operative infections can be prevented in the morbidly obese (Martin et al., 2017).

Revision and Reoperation

Morbidly obese patients are more likely to need a revision of the total knee arthroplasty in the future (Hakim et al., 2020; Sun & Li, 2017). A systemic literature review conducted by Boyce et al. (2019) demonstrated that patients diagnosed with morbid obesity had higher instances of total knee revision. The mean revision rate was 7% on morbidly obese patients and only 2% in nonobese patients (Boyce et al., 2019). They also have increased rate of reoperation within 30 days (George et al., 2018). **"**Causes of revision TKA include infection, mechanical loosening, implant failure, dislocation, osteolysis, periprosthetic fracture, and other mechanical complications" (Electricwala et al., 2017, p. 252). Patients with morbid obesity are more likely to need a revision due to a deep infection (Martin, Jennings & Dennis, 2017). Patient with an elevated preoperative BMI have a 130% increased relative risk of total knee arthroplasty revision due to early infection (Electricwala et al., 2017). It is well studied that morbidly obese patients have an increased risk of post-operative infections, which is a cause for a revision of a total knee arthroplasty. This can help explain why this population is at an increased risk for revisions in the future.

Deep Vein Thrombosis and Pulmonary Embolism

There is conflicting information in the literature regarding morbidly obese patients having an increased risk of deep vein thrombosis (DVT) and pulmonary embolism (PE) following a total knee arthroplasty. Risk of DVT is not shown to be increased in patients with morbid obesity in a study conducted by Meller et al. (2016). Pulmonary embolism incidence was

also not increased in morbidly obese patients (Adhikary et al., 2016; Si et al., 2015; Sun & Li, 2017). A study by D' Apuzzo et al. (2015) also revealed that patients with morbid obesity did not have an increased risk of thromboembolism. The study conducted by D'Apuzzo et al. (2015) examined patients selected from the National Inpatient Sample (NIS) database that underwent a primary total knee arthroplasty. There were 1,777,068 patients that matched that description. The morbidly obese patients were matched with a nonobese patient based on age, sex, and comorbidities. There were 90,045 morbidly obese patients matched to a patient with a normal BMI that were analyzed in this study (D'Apuzzo et al., 2015). The odds ratio for both PE and DVT were found to be 0.8 in this study (D'Apuzzo et al., 2015).

Morbidly obese patients had an increased incidence of PE (George et al., 2018; Si et al., 2015). The study conducted by George et al. (2018) examined data from the American College of Surgeons National Surgical Quality Improvement Database between 2011 and 2015. Patient was divided into groups based on their BMI. There were normal, overweight, obese, and morbidly obese groups. In this study 0.39% of patients with a normal BMI had a PE and 0.75% of morbidly obese patients had a PE (George et al., 2018). The odds ratio of PE in morbidly obese patient and normal BMI patient was found to be 2.35 (George et al., 2018). They also have an increased risk of DVT compared to nonobese patients (Sun & Li, 2017). Sun & Li (2017) conducted a meta-analysis and found that there was an odds ratio of 1.6 in patients with a morbid obesity versus patients that have a normal BMI or are considered overweight. As BMI increases so does the rate of DVT in morbidly obese patients (Si et al., 2015). A meta-analysis conducted by Si et al. (2015) showed that in morbidly obese patients there is an odds ratio of 2.70 for DVT compared to normal BMI patients. Although some studies reveal that there is an increased

incidence of PE and DVT in morbidly obese patient the actual risk of a thromboembolic event is low (Martin et al., 2017)

Myocardial Infarct

Myocardial infarct (MI) is another very serious complication following a total knee arthroplasty. Myocardial infarct and systemic cardiac complications have not been shown to be a complication that is increased in morbidly obese patients (Adhikary et al., 2016; D'Apuzzo et al., 2015; Meller et al., 2016). A study by George et al. (2018) displayed that morbidly obese patients were not at an increased risk of myocardial infarct. In this study the odds ratio of an MI was 0.54 in morbidly obese patients compared to patients that had a normal BMI. It is recommended that morbidly obese patients should be monitored carefully post-operatively for cardiovascular events (Martin et al., 2017).

Readmission

There are increased rates of 30 and 90-day readmission in morbidly obese patients following a total knee arthroplasty (George et al., 2018; Meller et al., 2016). A study by George et al. (2018) showed that morbid obese patients had an increased rate of readmission within 30 days. In the study 3.53% of nonobese patient that underwent a total knee arthroplasty were readmitted compared to 4.23 % of morbidly obese patients were readmitted (George et al., 2018) A study done by Meller et al., (2016) showed that patients with a normal BMI were found to have an 8.1% readmission rate and morbidly obese patients had a readmission rate of 9.9% within 90 days. Readmissions can be costly and preventing them especially in the morbidly obese who are at increased risk is important to help decreased healthcare spending.

Restricting BMI for Operation

Throughout conduction of the literature review there was conflicting information regarding optimizing BMI prior to surgery. One study by George et al. (2018) recommended a goal BMI of 29-30 kg/m^2. Another study also concluded that a BMI of 30 kg/m^2 may be the optimal BMI level and patients with greater BMI are at increased risk for infection as well as a DVT (Si et al., 2015). At a BMI of 40 kg/m^2 there is another level where deep infection rate rises (Si et al., 2015). A study by Adhikary et al. (2016) revealed that after a BMI of 45 kg/m^2 odd ratios of complications post-operatively increased. Risk versus benefits analysis should be done for these patients and increased BMI itself should not preclude these patients from surgery (Adhikary et al., 2016). However, a literature review by Boyce et al. (2019) concludes that patients should not be excluded from a total knee arthroplasty based on their BMI alone. Morbid obesity alone is not the sole predictor for postoperative complications after a total knee arthroplasty (D'Apuzzo et al., 2015). It could be beneficial to encourage patients to lose weight prior to total knee arthroplasty to help decrease post-operative complications (Si et al., 2015).

Recommendations

Patients that are morbidly obese typically have more comorbidities that nonobese patients and it is recommended to medically optimize their health and comorbidities to help decreased postoperative complications (Sun & Li, 2017).

- Educate morbidly obese patients who are undergoing a total knee arthroplasty the fact that postoperative complications are more common due to their high BMI and discuss risk versus benefits with these patients.
- Patients should be educated on signs and symptoms of these at-risk complications including infection, wound dehiscence, DVT, PE, and MI.

- Additional research needs be done regarding an optimal BMI for total knee arthroplasty operation to prevent postoperative complications.
- Literature suggest that post-operative infection is a common complication in patients that are morbidly obese.

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