



Ethical considerations in shoulder arthroplasty in patients who are obese

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Obesity and osteoarthritis are two of the most common conditions in the United States and often co-occur. Obese patients with osteoarthritis are at increased risk for complications when undergoing total shoulder arthroplasty (TSA). The ethical consideration relevant to the decision to perform TSA in obese and morbidly obese patients who may benefit from surgery is not well understood. We performed an ethical analysis for patients undergoing TSA who are obese by analyzing the 4 core bioethical principles, beneficence, nonmaleficence, autonomy, and justice. To provide the most benefit to patients, counseling patients on weight loss before surgery should be attempted including bariatric surgery or weight loss medication in select patients. To respect the ethical principles of beneficence and nonmaleficence, the surgeon must carefully weigh the potential for debilitating progression of disease, pain, and the psychological toll of osteoarthritis against the concern that obese patients may have a higher risk of complications. Respecting patient autonomy requires a rigorous, standardized consent process, which is informed by an understanding of common cognitive biases that affect patient understanding and minimization of perverse incentives that make it more difficult for the surgeon to spend adequate time and resources counseling the patient. Improving incentives for hospitals and physician alike to treat patients with obesity and other comorbidities will provide most just care while minimizing long-term harmful effects to the patient, surgeon, and health-care system.

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Obesity, which affects one-third of the US population,³⁹ is associated with an increased risk of osteoarthritis.⁵³ These 2 conditions are leading causes of morbidity in the US with increasing prevalence.⁵³ In obese patients with shoulder osteoarthritis undergoing surgery, there is increased risk of infection, deep vein thrombosis, and readmission.⁸ While many of these patients may benefit from surgery, this increased risk of complications may cause surgeons or insurance companies to defer surgical intervention on these patients. The ethical considerations relevant to the decision to perform total shoulder arthroplasty (TSA) in obese and morbidly obese patients who may benefit from surgery is not well understood. We performed an ethical analysis for patients undergoing TSA who are obese by analyzing the 4 core bioethical principles, beneficence, nonmaleficence, autonomy, and justice.² While we focus on the ethical permissibility of deferring TSA, we also

comment on other ethical considerations in performing TSA in this population.

Beneficence

The principle of beneficence, in its most general form, requires that physicians act to promote their patients' best interests. When offering surgical vs. nonsurgical options to patients, beneficence requires that physicians offer patients treatment options that are likely to benefit the patient. Typically, there are several reasonable treatment plans that have the potential to benefit the patient. Patients and physicians choose among the potentially beneficial management options using a shared decision-making framework.¹³ Physicians contribute medical expertise, while patients prioritize the risks, benefits, and burdens of treatment options according to their own values.¹³

How then should a surgeon approach the conversation with patients with glenohumeral arthritis and obesity? The benefit of TSA for patients suffering from glenohumeral arthritis has been well documented.^{22,38} Recent studies have investigated the benefit of this procedure on the obese population. Klein et al concluded

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that there were no significant differences observed in the American Shoulder and Elbow Surgeons Shoulder scores or complications for obese compared to nonobese patients.²³ The American Academy of Orthopedic Surgeons also released a comprehensive study on guidelines for management of glenohumeral joint osteoarthritis, with strong evidence suggesting that obese patients do not experience an increased rate of early complications.²¹ Conversely, Cogen et al performed a matched cohort analyses that demonstrated higher odds of readmission, deep vein thrombosis, and pulmonary embolism, superficial infection, and prosthetic joint infection at 90 days in obese TSA patients, while mechanical surgical complications and revision surgery rates were the same as nonobese patients.⁸ This study suggested that the findings are likely related to the well-known burden of obesity comorbidities, and that patients should be counseled accordingly about the overall risks that obesity has with hospital admission.

Nonoperative management should also be discussed in detail with obese patients to emphasize the varying success of options such as physical therapy, anti-inflammatory medications, hyaluronic acid, and injectable biologics.^{1,21} For patients that have failed conservative management, the principle of beneficence calls the physician to make recommendations and decisions that focus not only on preventing harm but also improving health. The option to receive TSA should be presented to the patient because of its potential to improve overall health, even though the surgeon may be concerned to avoid the real or perceived increased risks of surgery in obese patients.

In determining the benefit of reverse TSA in obese patients, studies demonstrate significant improvements in both pain and function; however, these levels are still lower than their nonobese counterparts.^{19,52} Other studies show clinical and functional improvements across all measured outcomes regardless of body mass index (BMI).^{34,36,47} Patients should be counseled that they may experience poorer internal rotation and forward elevation as a result of their higher BMI.¹²

Although bariatric surgery is a mainstay treatment of many different obesity types, it has been associated with increased complications when performed both before and after TSA. Marigi et al reported that bariatric surgery performed within 2 years before TSA increased the risk of complications, reoperations, and revisions.³² Cancienne et al⁶ compared groups that had bariatric surgery both before and after TSA and found increased mechanical loosening and instability with the “after” group. If bariatric surgery is of interest to the patient, it may be beneficial to suggest having the procedure before scheduling a TSA. A study from Congusta et al support this recommendation, finding more favorable length of stay, discharge destination, and complication rates with prior bariatric surgery patients compared to morbidly obese patients with no bariatric surgical history.⁹

To provide the most benefit to an obese patient with surgery, additional considerations should take place preoperatively, intraoperatively, and postoperatively. Preoperative planning strategies may minimize risk in TSA including optimizing nutritional status and medical management of other comorbidities often associated with obesity. Concerning medical management of weight and hemoglobin A1c, Semaglutide has emerged as an increasingly popular incretin mimetic known for significant weight loss. Semaglutide has been studied in obese patients undergoing total hip arthroplasty and was shown to reduce both 90-day readmissions and 2-year prosthetic joint infections.^{14,31}

Intraoperative considerations include meticulous soft tissue management, deep vein thrombosis prophylaxis, larger surgical teams, specialized instrumentation, adequate fixation with stems and components with cortical interface, and robust wound closure including the potential utilizing of wound vacs. Gruson et al

showed no increase in surgical time with TSA in morbidly obese patients,¹⁷ which would therefore not increase infection rates strongly associated with surgical time >180 minutes as shown by Schmitt et al.⁴⁸

Postoperative considerations include techniques to minimize the risk of wound drainage, length of stay, and postdischarge costs. A coherent team of consistent nursing staff, therapists, mobility specialists, nutritionists, and medical social workers specifically tasked with improving the postoperative care and timely discharge (even same-day discharge) of patients has been shown to be extremely beneficial.⁵

While conservative care may help some patients, timely arthroplasty in select patients may more quickly relieve pain while improving quality of life. Nevertheless, trialing weight loss medications or bariatric surgery and losing weight may result in a lower risk surgery and provide the additional benefits of improved cardiovascular and metabolic health. A shared decision-making approach suggests that weight loss before elective joint arthroplasty should be presented as an option for patients. However, weight loss and weight loss therapies should not be made a condition for offering TSA. The instinctive and historical association between BMI and total joint arthroplasty (TJA) postoperative complications have not been substantiated. In the current state of our knowledge, it remains uncertain which patients with obesity will benefit from weight loss therapy before TJA and which patients will benefit from TJA without trialing weight loss therapies. The principle of beneficence requires that all potentially beneficial strategies be offered to patients.

Nonmaleficence

To practice nonmaleficence, a physician is morally obligated to not harm a patient. This principle is more applicable to intentional harm than inadvertent harm. However, one may be culpable for inadvertent harm if it results from practicing outside of one's scope, not maintaining competencies or inappropriate actions such as performing surgery while fatigued or inebriated. When following the medical standard of care by adhering to treatment algorithms and proper surgical technique, complications that arise from surgery are not preventable or predictable. Surgeons may sometimes wrongly employ the principle of nonmaleficence to shield themselves from difficult surgical cases which carry increased risk. One might reason that a surgeon is culpable for a surgical complication if the surgeon knowingly operated on a patient with increased surgical risks. However, this reasoning is flawed because even patients with a high risk of surgical complication may benefit from surgery when all the benefits and burdens of surgery are tallied together. If surgical management is indicated and a comprehensive informed consent is provided by the patient, then even higher-risk surgical candidates have a moral basis for receiving the procedure.

Due to the presumed increased risks for TSA in the obese population, hesitancy to operate on these patients is likely based on the principle of nonmaleficence. Attempts to lose weight before surgery may decrease this risk, although weight loss can be extremely difficult for patients living with debilitating pain due to glenohumeral arthritis. As previously discussed, there are several potential interventions to manage weight, including bariatric surgery and semaglutide, although it is unclear if this lowers potential surgical risk to the patient. Withholding definitive surgical management of glenohumeral arthritis, with or without prior conservative efforts, is contrary to the principle of nonmaleficence if the patient is able to make an informed decision when presented with information about the increased risk of arthroplasty in obese patients. Surgeons may lose the patient trust and damage the physician–patient

relationship by allowing pain, disease progression and further debilitation to occur in the period of time surgery is deferred.

Of note, there are certain superobese patients (BMI > 50) that represent a category of patients that are at increased risk for complications including infection, dislocation, component loosening, and deep vein thrombosis, when compared to nonobese controls. The findings however were not statistically significant when compared to obese (BMI 30–40) and morbidly obese (40–50), indicating that there is not a well-defined value for increased risk based on BMI.

As obesity is quite visually evident in patients who present for evaluation, it may wrongfully be the deciding factor as to why timely arthroplasty is not offered as a definitive treatment option. Because weight control is an essential component of health overall, arthroplasty offered to an obese patient in a timely manner without unnecessary delays may also be extremely beneficial as it improves patient activity and function while reducing significant pain, improving mental health, and eliminating disease progression. The increased rates of mental health disorders including depression and anxiety in patients living with chronic pain or symptomatic arthritis is well documented.^{10,24,33,46} It is also been documented that patients with depression who undergo primary reverse total shoulder arthroplasty (rTSA) have statistically significant longer length of stay, higher complications (such as pneumonia, cerebrovascular incidents, myocardial infarctions), and increased costs of care.¹¹ Grandizio et al found that an overwhelming majority of obese patients achieved clinically meaningful weight loss and had better glycemic control after TSA.¹⁵ An obese patient who has been turned away from other surgeons unwilling to operate is at an increased risk of furthering harm in the form of chronic pain induced depression and may also affect chronic metabolic diseases.

From the standpoint of nonmaleficence, a surgeon who maintains competency and follows the standard of care would not be morally culpable for complications should they arise. If appropriate informed consent was obtained, and the patient has been made aware of their increased risk, the results of a complication-based root cause analysis could only point towards causes outside of the surgeon's control, therefore removing the surgeon from legal liability. The principle of nonmaleficence should not be used as a reason to exclude obese patients from TSA. Instead, increased risks in this population, should they be real, should be managed in a shared decision-making process in which the option of timely arthroplasty for management of debilitating glenohumeral is explored.

Respect for patient autonomy

Patient autonomy requires the physician to educate patients on the risks and benefits of management options, and through shared decision making, guide the patient to proceed with treatment options that align with their goals of care. Of the published frameworks for shared decision making, we are drawn to Elwyn's framework, which suggests dividing the process into team talk which lays out the partnership between patient and physician, option talk, in which the physician explains the patient's options, and decision talk, in which the patient expresses a decision. Shared decision making is not always practiced within Orthopedic Surgery.⁵⁵ Barriers to shared decision making can include low health literacy, patients' reticence to express opinions in the presence of physician "experts," financial incentives to decrease the amount of time spent counseling patients. These barriers can be minimized by training in a shared decision-making framework, utilizing patient decision aids, adjusting scheduling and other office practices to allow time for counseling patients and, where possible, adjusting financial incentives to promote shared decision making. Goal

concordance has been pioneered in palliative medicine as a quality metric that measures the alignment of patient preferences and treatments received. Financial incentives based on this metric encourage adequate time for patient counseling.

Within this shared decision making, it may be difficult to ascertain if patients fully appreciate the risks of a surgery to be able to provide a valid informed consent. Blackwood et al laid out essential components of informed consent in shoulder arthroplasty to attempt to meet this challenge.⁴ At the core, consent requires the patient's desires, their level of knowledge about their condition and management, the complexity of the treatment and the risk associated with surgery vs. nonoperative treatment. To comply with these standards, there is evidence that prewritten tailored consents may standardize how these risks are outlined to patients.⁵¹ Furthermore, consideration of social barriers including patients living alone, have nonsupportive relationships, lack adequate transportation, or have inability to pay for physical therapy should be considered within patient risks and understandings of treatment requirements.

While a clear outline of risks is important, benefits and how the patient may improve is also essential. For example, a patient who is passionate about weightlifting but has rotator cuff arthropathy and would benefit from a rTSA, should know their pain will likely improve, but also know they will have significant weightlifting restrictions. Obese patients have similar patient-reported outcome measures after shoulder arthroplasty compared to nonobese patients with slightly lower internal rotation⁵⁰ even though these metrics are significantly lower in obese patients preoperatively. Other literature has shown patient-reported outcome measures, motion and complications to be similar between these 2 groups.³⁴ At any rate, discussion of outcomes should be tailored to the specific lifestyle and values of the patient.

Conversely, even if higher risks patients give full informed consent after a full explanation of the risks and benefits, patients are unlikely to have the clinical experience of witnessing, much less living with, severe complications like infection, dislocation, and limited use of an extremity. There is evidence that patients fail to understand surgical procedures³⁷ through information from handouts with some benefit from multimedia. To respect autonomy, surgeons should weigh other principles of nonmaleficence and beneficence through the informed consent process. From a legal perspective, the malpractice literature highlights the fact that many do not feel they received adequate consent.³ Furthermore, patients who feel economic pressures to return to work may be inclined to accept surgery despite the possibility of poor outcomes. Patients should be aware that return to work following TSA ranges from 71%–93% and only 56%–65% following rTSA, with lower rates in those with moderate- to high-demand jobs.²⁶ Other comorbidities as well as economic and educational disparities may increase patients risks for complications and should be considered in the patients risk assessment preoperatively.⁴³ Years of pain and debilitation, with frustrations of unsuccessful nonoperative management can further push patients towards operative intervention while minimizing risks of complications. Patients with increased risk factors for shoulder arthroplasty should have a rigorous assessment of their ability to understand risk and benefits preoperatively to respect patients' autonomy.

It is essential for the surgeon and patient alike to minimize bias through the informed consent process. Through cognitive heuristics (also called cognitive biases), patients may make a decision based off of their interaction and rapport with the physician more so than the quality of the content delivered by the physician.⁴⁵ Studies have shown patients have an optimism bias that their risk is lower than others⁵⁴ and that the optimism bias is increased in older patients.⁷ Framing may alter how patients view their risks, for

example, risks given as percent survival (rather than percent mortality) will be viewed as more acceptable by patients.²⁹ Furthermore, patients ability to understand and maintain information may be described by the fuzzy trace theory in which patients understand the “gist” of their condition and treatment versus a more nuanced, detailed version.⁴⁴ How the physician frames something as “good vs. bad” or “high vs. low” is more likely to be understood or remembered than a specific number. Risks and specific details, even in the short term, can be forgotten while the summary of the patient’s condition remains most stable.^{30,49} These cognitive biases may alter the patients thinking and move their decision away from one based on evidence and values. Understanding the patient’s values over several visits may allow the physician to understand their misconceptions and motivation for treatment decisions. This may be an additional benefit of weight loss trials. Ultimately creating rapport and trust with the patient to share their understanding of treatment and desires is required to obtain informed consent via shared decision making and support autonomy. A rigorous, standardized consent process, informed by an understanding of common cognitive biases that affect patient understanding, and minimizing perverse incentives for both patient and physician supports fully respecting patient autonomy in decided whether to undergo shoulder arthroplasty.

Justice

The Principle of Justice includes the fair treatment within the health-care system. In a perfect world, all those who would benefit from TSA and who wish to have the procedure would receive it. However, in the actual world, how health care is financed influences who can receive TSA. Both for-profit and not-for-profit health-care systems must generate profit to remain in existence. Financial incentives to provide fast care with low complication rates and predictable outcomes tend to favor offering TSA to lower risk candidates, even though there are many patients with a higher risk profile who may benefit from the procedure. Bundled payments for shoulder arthroplasty fail to consider the increased difficulty in obese patients and disincentivizes care to these patients. Stratifying quality metrics by risk factors such as obesity may incentivize the physician and hospital to provide holistic care to these patients including diet, rehabilitation, medical optimization, and surgical staffing to best facilitate positive outcomes. Physicians should become advocates on a national level for fair reimbursement for this patient population to incentivize optimal care.

There are currently negative impacts on surgeons for performing longer, more intensive surgeries in patients with higher BMI. Of course, this decreases the time available for surgeons and staff to perform less complicated shoulder arthroplasty. Patients with larger shoulders make glenoid exposure, a critical portion of the case, much more difficult due to soft tissue obstruction and manipulation. This poor exposure may increase risk of poor glenosphere placement which can lead to early failure, scapular notching and other complications.⁸ To combat this, preoperative 3D planning may assist in accurate glenoid component placement.²⁷ Soft tissue envelope may make exposure of the humerus more difficult while trying to dislocate and manipulate the arm intraoperatively. TSA in obese patients takes longer but has similar complication rates at 30 days.²⁰ Continued expansion of artificial intelligence tools¹⁸ will continue to determine preoperative risk profiles. Due to these challenges, one might argue that patients with faster and more predictable outcomes may benefit more from surgery. Additionally, complications should be minimized as cost of revision, infection and take back to the operating room are extremely detrimental to the patient, physician, and hospital system. Patients who wish to best follow preoperative

counseling, including a weight loss trial or objective measures of minimizing risk factors may be the best candidates for surgery. Conversely, delaying care to patients who need an arthroplasty may increase future costs as patients’ disease process and comorbidities worsen. While decreasing the per capita costs of health care in the US is an ethical imperative, the literature on TSA outcomes does not unequivocally support trialing weight loss before TSA will reduce per capita costs. Rather, if there is a decrease in costs, it occurs at the level of local hospital and individual surgeon, with increased costs of not doing surgery being borne by other players in the health-care system.

Strict BMI cut offs may unfairly limit access to some patients, even though they may benefit from surgery. Kulkarni et al found strict cut offs decreased shoulder arthroplasty access to female and Black patients²⁵ as these patients are more likely to have high BMI. This violates justice by denying care unfairly to certain populations. Additionally, there is evidence obesity as a sole factor is not the reason for higher complications but that it is due to multiple comorbidities.⁸ BMI is flawed as it fails to assess percent body fat³⁴ or body composition. Thus, a BMI cut off may deny care to patients who would potentially benefit from surgery. Stigma may underlie some of these guidelines as weight loss may be viewed as a pre-operative modifiable risk factor, regardless of the circumstances.^{41,42} One paper found that 72% of obese patients undergoing shoulder arthroplasty had clinically meaningful weight loss, with improvements in glycemic control,¹⁵ suggesting arthroplasty may improve patients holistic health. Holding a strict cut off of BMI>40 may not fully capture the multifactorial patient factors regarding access to care and potential outcomes.

Obese patients who are younger are more likely to need shoulder arthroplasty.³⁵ Denying these patients TJA may unequally prevent return to work with significant economic impact on the individual. Liu et al found that 92% of patients under 55 were able to return to work with 64% of patients were able to return to hard work²⁸ after anatomic shoulder arthroplasty. There is evidence that rTSA comes at an increased cost in obese patients with patients requiring greater care or discharge to nursing facilities after surgery.^{16,40} While costs increase in the perioperative period, there could be some be financial benefit for patients who are able to return to work or a healthier lifestyle. Thus, while upfront cost may increase in obese patients, there are significant long-term financial ramifications for the patient and economic structure as a whole. Performing shoulder arthroplasty in the morbidly obese may improve function while decreasing pain. Nonetheless, individual surgeons, practices, and hospitals may bear the burden of high upfront costs, while other parts of the health-care system experience the cost savings.

Conclusion

Surgical decision making for obese patients requiring shoulder arthroplasty is expanding with the increasing rate of obesity and indications for shoulder arthroplasty. To provide the most benefit to patients, counseling patients on weight loss before surgery should be attempted. Nevertheless, with the unclear role of weight loss preoperatively through bariatric surgery or weight loss medications, there may be significant benefit for early operative intervention in select patients. To respect the ethical principles of beneficence and nonmaleficence, the surgeon must carefully weigh the potential for debilitating progression of disease, pain, and the psychological toll of osteoarthritis against the concern that obese patients may have a higher risk of complications. Increased complication risk for the obese patient. Respecting patient autonomy requires a rigorous, standardized consent process, which is informed by an understanding of common cognitive biases that affect patient understanding and minimization of perverse incentives that make it more

difficult for the surgeon to spend adequate time and resources counseling the patient. Improving incentives for hospitals and physician alike to treat patients with obesity and other comorbidities will provide most just care while minimizing long-term harmful effects to the patient, surgeon, and health-care system.

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