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Challenges of Spine Surgery in Obese Patients: A Case Report and Literature Review

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ABSTRACT

Introduction: Obese patients face unique challenges across all phases of spine care and surgery, including preoperative, intraoperative, and postoperative periods. Significantly higher risks are associated with spinal surgery in obese patients. This study explores the challenges of managing spinal conditions in obese patients and offers strategies to mitigate these risks.

Case report: A 56-year-old female with a BMI of 42 was referred for evaluation of chronic lower back pain and radicular leg pain. Imaging results were lumbar fusion for degenerative disc disease at the L4-5 and L5-S1 levels. During surgery, the patient required a prolonged operating time due to her increased soft tissue, which made visualization more difficult. The surgical team had to use longer instruments to navigate through the deeper tissue layers. Fluoroscopy was employed to ensure accurate placement of the fusion hardware. Postoperatively, the patient developed delayed wound healing, which required close monitoring and wound care interventions. She had significant reduction in back pain and improved mobility at her 6-month follow-up.

Conclusion: Obese patients present numerous challenges to spine surgeons, ie. elective and non-elective surgeries, anesthetic issues, operative challenges, post-operative issues, complications, and outcomes. To mitigate associated risks and optimize outcomes, specific precautions can be taken during the preoperative, intraoperative, and postoperative phases.

Keyword: Obesity; spinal surgery; treatment; case report; literature review.

1. Introduction

Obese patients face unique challenges across all phases of spine care and surgery, including preoperative, intraoperative, and postoperative periods. Given the rising prevalence of obesity and its strong association with back pain, spine surgeons are increasingly encountering obese patients presenting with spinal pathologies.[1-3] Jakoi et al. report that the prevalence of patients with both lumbar degenerative disc disease and obesity has grown more than fivefold compared to those with degenerative disc disease without obesity.[4] However, obese patients undergoing surgery are at a

significantly higher risk of perioperative complications, morbidity, and mortality.[5-19] Elevated body mass index (BMI) adversely affects surgical outcomes across all age groups, with studies showing poorer results for obese adolescents undergoing spinal fusion for idiopathic scoliosis and obese adults undergoing surgery for spinal deformities compared to their non-obese counterparts. [20,21]

Obesity, an escalating global epidemic, is increasingly recognized in spine-related research. A growing body of literature highlights the significantly higher risks associated with spinal surgery in obese patients. [5-19] For instance, Puvanesarajah et al. found that obese and morbidly obese patients over 65 undergoing lumbar fusion had notably higher odds of major medical complications, wound infections, wound dehiscence, 30-day readmissions, longer hospital stays, and increased in-hospital costs. [12] Similarly, Phan et al. determined that morbidly obese patients undergoing posterior cervical fusion had a higher risk of venous thromboembolism, while those undergoing anterior lumbar interbody fusion experienced an elevated risk of 30-day readmissions. [16,17] Burks et al. identified a correlation between obesity and increased rates of incidental durotomy during lumbar spine surgeries. [15] Consequently, spine surgeons may face complications during all phases of care—before surgery, during the procedure, and postoperatively. This paper explores the challenges of managing spinal conditions in obese patients and offers strategies to mitigate these risks.

2. Case Report

A 56-year-old female with a BMI of 42 was referred for evaluation of chronic lower back pain and radicular leg pain, which had significantly impaired her quality of life. She had been experiencing symptoms for over 18 months, which included severe pain that radiated down her left leg, causing difficulty with walking and performing daily activities. Conservative management, including physical therapy, NSAIDs, and several courses of epidural steroid injections, provided only temporary relief. Given her lack of improvement and the significant functional limitations, she was considered for surgical intervention, specifically lumbar fusion for degenerative disc disease at the L4-5 and L5-S1 levels.

Preoperatively, the patient underwent a thorough assessment, including a review of her comorbidities, which included obesity, hypertension, and mild obstructive sleep apnea. Given her obesity, the surgical team advised a weight loss program before surgery to optimize outcomes. Additionally, the patient was referred for a sleep study, and CPAP therapy was initiated to address her sleep apnea. The anesthesia team performed a careful evaluation, as her obesity posed an increased risk for difficult intubation and respiratory complications during surgery. The multidisciplinary team, including a nutritionist, was involved to provide preoperative guidance on managing her weight and comorbidities.

During surgery, the patient required a prolonged operating time due to her increased soft tissue, which made visualization more difficult. The surgical team had to use longer instruments, including bayoneted forceps and specialized retractors, to navigate through the deeper tissue layers. Fluoroscopy was employed carefully to ensure accurate placement of the fusion hardware, though the increased adiposity presented some challenges in obtaining clear images. Postoperatively, the patient developed delayed wound healing, which required close monitoring and wound care interventions. Despite this, she had a favorable outcome, with a significant reduction in back pain and improved

mobility at her 6-month follow-up. The patient was encouraged to continue with weight loss efforts and physical therapy, which further enhanced her recovery.

3. Discussion

Elective surgery

Obesity is a modifiable risk factor linked to various spinal disorders across age and sex groups.[21,22] Conservative treatments for elective spinal conditions may include physical therapy, injections, nonsteroidal anti-inflammatory drugs (NSAIDs), and muscle relaxants. The Spine Patient Outcomes Research Trial (SPORT) revealed that obese patients (BMI ≥30) with lumbar stenosis undergoing non-operative management experienced worse outcomes in the Oswestry Disability Index (ODI) and the bodily pain and physical function domains of the SF-36 compared to those with a BMI <30.[23] Similarly, while obese patients with degenerative spondylolisthesis reported similar bodily pain scores, they showed less improvement in physical function and ODI scores than their non-obese counterparts.[23] Obesity has also been identified as an independent predictor of treatment failure in physical therapy interventions.[24]

For conservative treatment, transforaminal epidural steroid injections (TFESIs) can provide effective relief for lumbar disc herniation and radicular pain.[25] However, administering TFESIs in obese patients poses challenges, such as difficulty visualizing landmarks during fluoroscopy and requiring longer needles. Cushman et al. found that obese patients undergoing lumbar TFESIs had significantly longer fluoroscopy times and higher radiation doses.[26]

Weight loss has been shown to positively impact back pain. For example, Khoueir et al. demonstrated that significant weight loss following bariatric surgery was associated with moderate reductions in preexisting back pain during early follow-up.[27] Similarly, Lidar et al. found that bariatric surgery led to significant reductions in low back and radicular pain, as well as an increase in L4-5 intervertebral disc height.[28] Preoperative weight reduction may prevent some patients from needing spinal procedures and could enhance surgical outcomes. Bariatric surgery, in particular, may be a valuable preoperative optimization strategy for elective spine surgeries.

One case report described a super-obese patient who experienced improvement in myelopathy after bariatric surgery, likely due to changes in spinal alignment.[29] Additionally, Jain et al. showed that patients undergoing bariatric surgery before elective posterior lumbar fusion had lower rates of respiratory failure, urinary tract infection, acute renal failure, infection, overall medical complications, and shorter hospital stays compared to obese patients with a BMI over 40.[30]

Non-elective surgery

As described by Rosenfeld et al., morbidly obese patients face significant logistical challenges even before arriving at a hospital.[31] For trauma patients or those found incapacitated, transportation and transfer to appropriate trauma centers can be delayed due to the unavailability of specialized equipment. Emergency medical services (EMS) often need to assess patient weight and size in advance to plan adequately.[32] Standard stretchers typically have weight limits of 270–318 kg, but modified versions and specially designed ambulances may be required for larger patients. Weight and size constraints also pose challenges for air transport, as smaller EMS helicopters can accommodate patients up to 135 kg, and fixed-wing aircraft often have a maximum capacity of 260 kg.[32]

Additional pre-hospital challenges include obtaining intravenous access (sometimes necessitating intraosseous access), accurately measuring blood pressure with appropriately sized cuffs, and ensuring proper cervical spine immobilization when standard collars do not fit. In such

cases, stabilization may require alternative methods, such as taped towel rolls placed on either side of the head.

Upon arrival at a medical facility, morbidly obese patients face further obstacles with imaging.[33,34] Magnetic resonance imaging (MRI) is often restricted by weight limits for the table and girth limitations of closed MRI machines. Computed tomography (CT) imaging may also be compromised due to excess soft tissue causing averaging artifacts, which hinder visualization of bony structures. Even CT myelograms may offer limited utility in these cases. These imaging constraints can result in incomplete preoperative assessments, leading to potential misdiagnoses, suboptimal surgical planning, and increased operative risks. Clear communication with patients and their families about these limitations and their implications for surgical planning is essential.

Alternatives to surgery are equally constrained. For example, obtaining appropriately sized orthotics for obese patients can be difficult. Additionally, the distribution of soft adipose tissue, while providing extra protection for visceral organs, redirects trauma forces to axial and appendicular skeletons, increasing the likelihood of pelvic or extremity fractures in obese individuals.[34]

Anesthetic issues

When surgery is indicated, obese patients present significant challenges related to anesthesia management.[35,36] Obesity is commonly associated with comorbid conditions such as cardiac and pulmonary hypertension, ventricular dysfunction, heart disease, and obstructive sleep apnea, which necessitate thorough preoperative evaluation. Additionally, obese trauma patients often exhibit higher base deficits than non-obese individuals and are frequently under-resuscitated due to fluid and blood product volumes not adjusted for their size.[34] Preoperative optimization may be required, including BiPAP ventilation or respiratory physiotherapy, to improve respiratory function.

Airway management in obese patients is particularly challenging. Increased neck circumference and reduced visibility of the oropharynx can complicate intubation, often necessitating fiberoptic assistance. The risks associated with prone positioning are amplified in this population, as it increases the likelihood of airway compromise and requires meticulous planning. Douglass et al. describe using awake fiberoptic intubation combined with awake prone positioning to mitigate the difficulties associated with transferring an anesthetized bariatric patient into the prone position.[36]

Additional challenges include restrictive chest wall mechanics that make mechanical ventilation more difficult, reduced accuracy of monitoring, higher risk of endotracheal tube dislodgement, and increased susceptibility to airway edema and obstruction.[34] Positioning can also impact outcomes; for example, placing the patient in a lateral position can help alleviate cardiovascular issues by displacing the pannus away from the diaphragm and inferior vena cava.[34]

Postoperatively, residual anesthetic accumulation in adipose tissue may delay extubation. In some cases, a planned extubation in the intensive care unit may be necessary to ensure airway stability and patient safety.

Operative challenges

Cao et al. conducted a meta-analysis showing that obesity in lumbar spine surgery is linked to longer operative times, greater postoperative blood loss, higher risks of surgical site infections, and increased incidence of nerve injuries.[37] Similarly, Lingutla et al., in a systematic review and meta-analysis of lumbar spine fusion, found that obese patients experienced greater intraoperative blood loss, longer surgeries, and higher complication rates compared to non-obese patients.[8]

Several studies also highlight the association between increased BMI and greater blood loss or transfusion requirements. Onyekwelu et al. found that obese patients undergoing lumbar fusion needed more blood products and had extended hospital stays.[38] Shamji et al. reported that higher BMI was associated with increased transfusion needs and higher likelihood of discharge to assisted living following thoracolumbar spine fusion.[39] The longer operative duration in obese patients may contribute to increased blood loss, potentially exacerbated by heightened venous bleeding due to elevated intraabdominal or intrathoracic pressures.

Surgical site infections (SSIs) are more prevalent in obese patients. Olsen et al. identified morbid obesity (BMI >35) as an independent risk factor for SSIs in spine surgery.[19] Preventive measures, such as applying intra-wound prophylactic vancomycin powder, have been shown in multicenter studies, systematic reviews, and meta-analyses to reduce SSI risks, though concerns about gram-negative infections, polymicrobial infections, or pseudoarthrosis remain.[40-44]

Operating room setup and positioning also pose unique challenges in obese patients.[34] Proper patient positioning often requires specialized equipment and teams to ensure the safety of both patients and staff. Some patients may exceed the weight limits of standard spine-capable operative tables, which typically range from 500 to 1,000 pounds. In such cases, creative solutions such as using two flat Jackson tables belted together with a Wilson frame may be necessary if the frame has an adequate weight rating.

Fluoroscopy is another area of difficulty in obese patients due to compromised imaging quality caused by excess soft tissue.[33] Poor visualization increases the risk of wrong-level surgery. Anteroposterior (AP) imaging can assist in level localization and midline identification, especially when surface landmarks are obscured.

Technical surgical challenges in obese patients include restricted operative corridors, limited visualization, and difficulty achieving optimal instrumentation. Longer incisions may be required, and specialized instruments, such as bayoneted bipolar forceps or Kerrisons, can help navigate deeper surgical fields.

While minimally invasive surgery (MIS) techniques have demonstrated favorable outcomes, their use in obese patients remains complex. Studies suggest that obese patients may experience longer surgery times, higher complication rates, and less clinical benefit compared to non-obese individuals.[45,46,47] For instance, Bohl et al. identified greater BMI as an independent risk factor for revision surgery following single-level MIS lumbar discectomy.[48] Nevertheless, compared to open procedures, MIS techniques may reduce incision length, blood loss, operative time, and hospital stay, offering potential advantages even in this challenging patient population.[49]

Post-operative issues, complications, and outcomes

Postoperative care for obese patients emphasizes early mobilization to reduce complications. Safe mobilization often requires additional personnel and specialized equipment. Tools like motorized ceiling lifts and the use of "lift teams" have been shown to lower the incidence of hospital-acquired pressure ulcers, decrease patient handling-related injuries among healthcare staff, and enhance employee satisfaction while reducing hospital costs.[50]

A multidisciplinary approach is essential for postoperative care, involving nutritionists, dietitians, social workers, and physical and occupational therapists to address the comprehensive needs of obese patients. Venous thromboembolism (VTE) prevention is a priority in this population, as obesity significantly increases VTE risk, particularly in trauma patients.[31] Sequential compression devices (SCDs), if appropriately fitted, combined with weight-adjusted dosing of low

molecular weight heparin (LMWH) prophylaxis, can help mitigate the risk of deep venous thrombosis (DVT) and pulmonary embolism (PE). For high-risk individuals, such as obese patients with spinal cord injuries, additional measures like prophylactic vena cava filters or initiation of anticoagulation therapy may be appropriate and have been successfully utilized in prior studies.[51]

4. Conclusion

Obese patients present numerous challenges to spine surgeons. To mitigate associated risks and optimize outcomes, specific precautions can be taken during the preoperative, intraoperative, and postoperative phases.

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