

## Fat is Bad? Lumbar Discectomy in Patients with High Body Mass Index

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### Abstract

**Objective:** Spine surgeons are experiencing increased morbidly obese patients with lumbar spine pathology in regular practice. There is a close association between back pain and morbid obesity, particularly due to chronic stresses on the spine. Our objective of this review of literature is to identify the difficulties encountered by the spine surgeons in lumbar spine microdiscectomy and to provide possible solutions for the same. All pre-operative, intra-operative including surgical techniques and post-operative complications with clinical outcomes are taken into consideration.

**Methods:** obesity was defined as body mass index (BMI) more than 30 kg/m<sup>2</sup> whereas Morbidly obese are the people who have BMI more than 40 kg/m<sup>2</sup> or BMI 35 kg/m<sup>2</sup> associated with at least 2 co morbid conditions. Keywords were taken as Micro discectomy, lumbar spine disease, morbidly obese, obese, obesity related spine pathology, spinal surgery in obese, Body mass index. This review article examined articles published concerning "lumbar microdiscectomy in obese patients" on Pub Med and Google scholar. We also included some articles related to lumbar fusion surgery in obese patient. Articles in which lumbar spine surgeries operated on non-obese patients and surgeries performed at cervical and dorsal level were excluded. We included 71 articles published on the related topic

**Results:** Review illustrated that obese patients were at higher risk of complications at all stages of management. Pre-operatively obese patients showed inferior outcome to conservative management. Health care professionals are challenged in transportation, imaging, and resuscitation procedures of obese patients because of large body fat. Intra operatively obese patients have showed increased blood loss, operative time and infection rates. Even surgeries in obese patients were technically demanding. Obese patients demonstrated inferior clinical outcomes, increased complications rates compared to non-obese patients. Minimally invasive spine surgery has shown better and promising results in lumbar discectomy.

**Conclusion:** lumbar surgeries on obese patients is fraught with multiple challenges starting from preoperative period might through the surgical procedure and rehabilitation With the increasing availability of technology and surgical expertise, MIS has proven to be equally effective, if not better, than traditional lumbar surgeries in this group of patients. Smaller surgical incisions, early mobilization and shorter duration of hospital stay are some of the advantages of this technique

**Keywords:** Micro discectomy, Lumbar spine disease, Morbidly obese, Obese, Obesity related spine pathology, Spinal surgery in obese, Body mass index.

### Introduction

Obesity is now a global health problem. Lifestyle has changed significantly due to sedentary work habits with changing technology. Hence morbid obesity in general population is in increasing trend all over the world. Spine surgeons are experiencing increased morbidly obese patients with lumbar spine pathology in regular practice [1, 2, 3]. There is a close association between back pain and morbid

obesity, particularly due to chronic stresses on the spine [4]. World health organization defined obesity as body mass index (BMI) more than 30 kg/m<sup>2</sup>. Morbidly obese are the people who have BMI more than 40 kg/m<sup>2</sup> or BMI 35 kg/m<sup>2</sup> associated with at least 2 co morbid conditions[5]. Multiple risk factors are connected with obesity but not restricted to type 2 diabetes, hypertension, osteoarthritis due to heavy stature, sleep apnea including respiratory problem, gastro

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esophageal reflux diseases, depression, and back pain [6].

Jakoi et al clinically correlated the association between the obesity and lumbar intervertebral disc herniation and concluded that the prevalence of intervertebral disc herniation was 5 times higher in obese patients as compared to non-obese patients [7].

Peri-operative risk of morbidity and mortality was higher for obese patients undergoing surgery [8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18]. With obesity becoming a global epidemic, there are frequent reports on the increased morbidity and mortality for patients undergoing surgery, both from a surgical and an intensive care viewpoint [19]. In 2015 Burks et al demonstrated significantly increased rates of incidental dural injury in surgeries of lumbar spine in obese patients [20].

There is no doubt that the spine surgeon has to be prepared to tackle these difficulties even before taking patients to the operating table, during the surgical procedure, and in the rehabilitation phase. In this article we reviewed the published literature on challenges presented to the spine surgeon by obese patients and present our experience in the same context.

### Methods

The procedure of Lumbar microdiscectomy in morbidly obese patients was reviewed in terms of hurdles encountered in preoperative, peri-operative and postoperative period. We reviewed the recommendations listed on respective articles and then proceeded to formulate general recommendations to address this issue.

Keywords used for search were: microdiscectomy, lumbar spine disease, morbidly obese, obese, obesity related spine pathology, spinal surgery in obese, Body mass index.

Sources for literature search were: Pub med and Google scholar. Relative conclusions were assessed thoroughly in relevance of topic of discussion. We reviewed the literature and secondary reviews were performed through associated mentioned articles. This review article examined articles published concerning "lumbar microdiscectomy in obese patients" on Pub Med and Google scholar. Articles in which lumbar spine surgeries operated on non-obese patients and surgeries performed at cervical and dorsal level were excluded. We also included some articles related to lumbar fusion surgery in obese patient.

### Discussion

We have followed a format of discussion that allows us to discuss the various aspects of obesity in the treatment journey of the lumbar microdiscectomy patient. Each subsection addresses the problem statement, the available evidence and our recommended guidelines. Preoperative considerations and challenges including the role of bariatric surgery in treating spinal disc disease.

Biopsychosocial risk factors and co-morbidity for common spinal disorders were reviewed and it was noticed that obesity was a modifiable risk factor in various low back pain related complaints in all age and sex groups [21]. Only 10- 20% of lumbar disc herniation patients required surgery and most of the patients could be managed conservatively. The conservative management includes bed rest,

physical therapy, analgesics, muscle relaxant, oral and local steroid injections [22]. Obesity was observed to be an accountable independent risk factor in physical therapy treatment failure for low back pain [23].

The conservative management for lumbar disc diseases also includes epidural steroidal blocks which are effective in lumbar disc herniation and radicular pain [24]. But the challenges in steroid epidural injections can occur while performing fluoroscopic imaging to position the patient appropriately and to identify and assess the anatomical bony landmarks due to extra deposition of adipose tissue in sub dermal layer under the skin. The needles required to perform the procedure needed to be of greater length. The mean fluoroscopic time and radiation dose while performing transforaminal epidural blocks in lumbar spine has been found to be significantly higher in morbidly obese patients than non-obese patients [25].

The weight loss alone after bariatric surgery can decrease lumbar back pain [26] and associated radicular pain and marked increase disc height [27]. Henceforth the weight loss in morbidly obese patients decreases the number of patients who underwent spinal surgery. The bariatric surgery and weight loss due to the procedure has been shown to improve the thoracic myelopathic symptoms in obese patients [28]. Patients who underwent lumbar posterior fusion after bariatric surgery had decreased rates of urinary tract infections, respiratory diseases, renal complications including acute renal failure and hospital stays when compared the patients of BMI more than 40 [29].

Although Bariatric surgery has been observed to be a beneficial In post-operative outcome of microdiscectomy in morbidly obese patients, but some studies have discovered high incidence of osteoporosis, lower bone mineral density, deficiency of vitamin D and elevated spinal fracture risk in patients following bariatric surgery [8]. The bone strength and bone density in spine and hip joints has been shown to deteriorate continually even years after the gastric bypass, despite maintaining steady weight and metabolic parameters [30]. The axial back pain relief after gastric bypass has to be balanced against the expected risk of bone mineral density loss [31]. Shawk et al demonstrated that the subcutaneous lumbar spine (SLS) index, as a targeted pre-surgical approach was very useful in predicting the outcome including complications in lumbar spine surgery [32]. SLS is the proportion of SAD (subcutaneous adipose depth) relative to spinal process height (SPH) dictated by MRI which also helps in deciding conservative options for lumbar spine related pain. SLS indicates distribution of body mass and is strongly associated with higher risk of intra-operative and post-operative complications. SLS index is found to have more accurate indicator for intra-operative complications than SAD and BMI. SLS index is very useful tool for spine surgeons to predict the intra-operative complication and helpful in preparedness preoperatively [32].

Several hurdles were faced while shifting the morbidly obese patient from home or incident site to the hospital [33]. The ambulances which shift patients may need modifications to fit morbidly obese patients. Most of the stretchers in hospital setting have standard weight limitation of 270-318 lb, so modifications were needed to

accommodate obese patients. The treating team faced multiple problems during regular treatment which included securing access to intravenous line, larger blood pressure cuff to serve bigger arm size, shifting patient from stretchers to beds and vice-versa [34].

Morbidly obese individuals faced challenges in obtaining basic investigations (MRI ,CT) [35, 36]. The magnetic resonance imaging (MRI) machine table has a limited maximum weight allowed and maximum girth permitted due to its closed dimensions ,so sometimes the MRI studies may not be possible. Because of excess adipose tissue, bony anatomy in CT scan is obscured and difficult to assess. CT myelogram also may not be helpful in this population [37]. Overall surgical risk increased because of inadequate imaging which results in wrong diagnosis, uninformed conservative versus surgical decisions, insufficient pre-surgical planning. Obese individuals who were considered for conservative treatment for lumbar disc pain in the form of orthotic brace (LSO brace), may need customized brace as appropriate size braces are usually not available [38].

### Anaesthetic challenges

Obese populations are at higher risk to anaesthetic complications and come with certain difficulties when compared to non- obese population [39, 40]. Preoperative evaluation requires a thorough systemic and metabolic assessment as BMI more than 35 represents a higher risk of diabetes mellitus, high blood pressure, pulmonary hypertension, ventricular insufficiency, obstructive sleep apnea, respiratory failure. Cardiac failure and other metabolic disorders [41]. The anaesthetic respiratory complications can be decreased by applying respiratory physiotherapy preoperatively. Obese individuals are observed to be more associated with difficult airway intubation as compared to non-obese which necessitates the use of Fiber optic intubation .The difficult airway is attributed to short neck, enlarged neck circumference, inadequate oropharynx visualization. Lumbar micro discectomy procedure requires prone position which further adds the risk of airway loss. Douglass et al demonstrated awake fiber optic intubation and awake prone positioning to achieve safe shifting to prone position of an anaesthetized post bariatric patient [40]. The morbidly obese patients are also associated with increased rates of difficult mechanical ventilations, limited accuracy in monitoring, more accidental removal of endotracheal tubes, higher incidence of airway obstruction due to edema [33]. The lateral position is expected to improve cardiothoracic symptoms as the panniculus is moved away from the inferior vena cava and diaphragm which are compressed in supine position [36]. Postoperatively extubation may be prolonged and difficult due to residual anesthesia drugs in adipose tissue and may necessitate the intensive care extubation.

### Operative challenges

Numerous studies have depicted worse outcomes for morbidly obese patient undergoing surgery. Cao et al in his met- analytic study found obese patients to have increased blood loss, increased chances of wound infection, higher nerve root injury in lumbar procedures, increased blood transfusion postoperatively and need of longer

hospital stay [42]. Patients with higher BMI needed longer postoperative stay in the medical setting which was predicted to be due to the increased blood loss intra-operatively [43]. This blood loss is a product of high intra-operative intra-thoracic and abdominal pressure because of large abdominal girth. The surgeon and anaesthetist should predict the blood loss beforehand and arrange the required blood components before surgery on morbidly obese patients The administration of tranexamic acid showed excellent results in reducing intra-operative blood loss and transfusion rate and should be administered appropriately [44, 45]. Obese patients also posed difficulty in neuro-monitoring because of larger adipose tissue deposition. This also meant that they required longer needles which can reach up to the muscles. Higher association with false positive alerts while taking reading of motor evoked potential monitoring was also seen in these patients [46].

Obesity and its association with higher rate of surgical site wound infection has been demonstrated by numerous studies in literature. BMI more than 35 is an independent risk factor in surgical wound infection [47] Several studies have advocated the use of intra-operative local vancomycin powder as a prophylaxis to prevent infection. However, some surgeons are conservative while using vancomycin placed locally in the wound intra-operatively, because of studies mentioning an associated higher incidence of polymicrobial and gram negative bacterial infection as well as its hindrance in bony fusion [48, 49, 50]. Other measures to decrease the chances of infection which are commonly practiced but with limited evidence are prophylactic intravenous antibiotic doses 30 minutes before the incision, saline irrigation of wound, mixing antibiotics and antimicrobial (povidone iodine) with saline, layer by layer closure occluding maximum dead space under the surgical site, use of negative suction drain, occlusive dressing and parenteral antibacterial coverage postoperatively [51, 52].

Morbidly obese patients present peculiar challenges in operation theater management. A multi-person team is required to shift the patient from stretcher to operation table and sometime needs machines up ported shifting [36]. The average weight limit of spine operating table is 150 to 200 kg. A morbidly obese patient may exceed the limit which could require two flat Jackson's bed, joined by belt with a Wilson's frame. Another challenge in prone positioning is the accommodation of the girth of abdomen. Tightly pressed abdomen on bolsters in prone position will increase the intra-abdominal pressure that will eventually result in higher epidural venous pressure and increased propensity of blood loss during the surgery [53]. An insufficient space to hang the abdomen of morbidly obese patients freely will also cause skin pressure breakdown and inability to have blood less field during surgery which will result in longer surgical time .The positioning of patients of head and neck is difficult because of large abdomen , which eventually increases the chances of facial sores, raised intraocular pressure and probability of vision loss [54] A sufficient padding over the face and eyes must be ensured if head holder is used . A skeletal cervical traction by tong with 8-10 pounds may be used to keep neck in neutral position to avoid the mentioned complications. The morbidly obese patients in prone position during surgery are at a higher risk of positioning

related peripheral neuropathy which can be prevented by applying extra padding to all pressure points in the extremities [10]. Strapping the patients with belts will increase the stability and decrease the movement of patients during surgery, preventing fall.

Intra-operative C- arm imaging is expected to be of inferior quality in patients with higher body mass index [35]. The extra fat tissue in abdomen obscures the satisfactory visualization in fluoroscopy imaging. This can lead to wrong level surgery or inaccurate pedicle screw positioning [43]. To overcome such difficulties, an anterior-posterior view (AP) view is taken to mark the level of incision which is intended to be operated. AP view will also help in finding the midline of spine which is a challenge in morbidly obese patients.

The Surgical challenges while operating on these patients are manifold – ranging from basic difficulties in draping, to difficulty in intra-operative visualization and requirement of specialized instruments [42]. Draping of morbidly obese patients demands the use of longer drapes, to accommodate the larger girth of these patients and also to cover the non-operative field. Folds of skin surrounding the incision site also prove to be a hindrance in incising the skin smoothly as well as during closure [44]. To keep the surrounding skin taut, wide silk tape can be used, but one must be wary of the risks of skin breakdown due to the excessive traction caused by the tape [43].

Intra-operative limitations while operating on morbidly obese patients could be narrow and deep surgical corridors, which result in inadequate visualization of the operative field [40]. Proper exposure in lumbar spine may require a longer incision and working in deeper operative fields could be technically more demanding and would require longer instruments (Kerrison's forceps, drills, disc forceps etc.). Occasionally, deeper than usual self-retaining retractors may be required to maintain adequate exposure throughout the surgery.

**Role of MISS in morbidly obese patients**

In order to bypass these surgical difficulties, many studies have advocated the use of minimally invasive surgery (MIS) for lumbar spine surgeries in morbidly obese patients [56]. Proper preoperative planning, especially anticipation of the length of self-retaining or tubular retractors, becomes absolutely mandatory in such cases. It is also prudent to always keep longer retractors standby. An additional advantage of MIS is the need for smaller skin incisions, which translate to faster healing, along with less blood loss and less chances of wound site complications [56, 57, 58, 59, 60]. The only 'drawback' of these techniques could be the increased requirement of fluoroscopy for accurate anatomical delineation, thereby resulting in increased radiation exposure for the surgical team [56]. However, with the advent of neuro-navigation, even this hurdle has been overcome to a significant extent [46].

MIS has been observed to have similar clinical outcomes when compared to traditional surgeries. The advantages of MIS are the need for smaller incisions, less intra-operative blood loss and shorter operative duration as well as duration of hospital stay [57, 58, 60]. MIS technique does, however, demand a steep learning curve because of its significant dependence on intra-operative fluoroscopy.

Although several studies have demonstrated similar clinical

outcomes with MIS as compared to traditional surgeries, the complication rates tend to be relatively higher and clinical outcomes poorer in morbidly obese patients as compared to non-obese patients [57]. In fact, in patients undergoing revision surgery after a single level lumbar microdiscectomy, greater BMI has been found to be an independent risk factor of poorer outcome. In such cases, percutaneous transforaminal endoscopic discectomy remained a good option and has shown comparable clinical outcomes and complications as MIS [61, 62]. However, appropriate patient selection for these surgeries is of paramount importance [56].

### **Post-operative complications and management**

Surgical site infections are quite common in obese patients, as the depth of incision and thick pad of fat can result in a larger dead space and also fat necrosis [47, 49, 50]. Multiple layer closure in order to prevent dead space formation reduced the incidence of postoperative collections and infection [48, 49, 50]. Also, in cases where there is significant dead space, a negative suction subfascial wound drain should be left in situ [53]. Pneumatic compression devices are essential in the lower limbs to reduce the risk of deep venous thrombosis [63]. Low molecular weight heparin prophylaxis and early mobilization also play a significant role in reducing its incidence. In some morbidly obese patients who are extremely high risk for development of deep venous thrombosis and consequent pulmonary embolism, the placement of an Inferior vena cava filter prophylactically has also been suggested [65].

Postoperative rehabilitation of obese patients is quite challenging as well, and requires a multi-disciplinary team, including physiotherapists, occupational therapists and nutritionists [64, 69]. Early postoperative mobilization of patients is crucial in order to prevent thrombotic complications of inactivity [10]. The patient's own weight can be a hindrance in adequate mobilization, and sometimes even motorized lifting machines need to be used for this purpose, in order to reduce the risk of falls or skin ulcers, and also prevent injury to the attending healthcare worker.

### **Long term outcomes**

Current literature stands divided in the comparison of long term clinical outcomes of lumbar surgery in obese patients versus non-obese patients. Onyekwelu et al. concluded that the average pain score 2 years following lumbar spinal decompression was greater in obese patients as compared to non-obese patients [59]. Giannadai et al. also demonstrated better outcomes in back pain and decreased hospital stay in non-obese patients are undergoing decompressive surgery for lumbar canal stenosis [66]. Some authors have reported higher reoperation rates after lumbar decompression in obese patients, and also worse sagittal alignment maintenance in these patients as compared to non-obese patients [67]. Bohl et al. demonstrated increased need for revision surgeries in patients with greater BMI [70].

Contrary to the aforementioned literature, studies have also shown no significant difference in clinical and radiological outcomes in obese and non-obese patients. Pereira et al. showed that intra-operative blood loss, wound related complications and the need for

revision surgery were not significantly different among the two groups [68]. Lingutla et al. demonstrated no significant difference in back pain following lumbar fusion surgery in the two groups [11]. MIS has also been shown to be equally effective in obese patients. Wolfgang et al. supported this finding by concluding that complication rates and operative duration while performing minimally invasive discectomies were not affected by the BMI of patients [71].

## Conclusion

Performing lumbar surgeries on obese patients is fraught with multiple challenges starting from preoperative period through the surgical procedure and rehabilitation. With the increasing availability of technology and surgical expertise, MIS has proven to be equally effective, if not better, than traditional lumbar surgeries in this group of patients. Smaller surgical incisions, early mobilization and shorter duration of hospital stay are some of the advantages of this technique. Postoperative rehabilitation, preferably by a multi-disciplinary team, is also a major determinant of long-term outcomes in these patients. Post op consideration 1) heparin prophylaxis and pneumatic compression pump to prevent deep venous thrombosis 2) early mobilization is essential.

**Declaration of patient consent :** The authors certify that they have obtained all appropriate patient consent forms. In the form, the patient has given his/her consent for his/her images and other clinical information to be reported in the Journal. The patient understands that his/her name and initials will not be published, and due efforts will be made to conceal his/her identity, but anonymity cannot be guaranteed.

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