Anesthetic management of morbidly obese parturient for cesarean section: A Case Report and Literature Review

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ABSTRACT

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The number of pregnant women with morbid obesity (BMI 40–49.9 kg/m^2) has significantly increased worldwide. Management of these patients presents a challenge for obstetric anesthesiologist. We report our management of cesarean delivery in a parturient with a BMI 47.3 kg/m^2. We present this case to emphasize usefulness of Tuohy needle as an introducer for performing spinal anesthesia with a long 27G pencil point needle. Literature review is discussed.

INTRODUCTION

The World Health Organization uses the body mass index (BMI) to stratify individuals into the following classes: normal BMI 18.9–24.9 kg/m^2; overweight BMI 25–29.9 kg/m^2; and obese BMI > 30 kg/m^2. Obesity is further sub-classified as class 1 for BMI 30–34.9 kg/m^2, class 2 for BMI 35–39.9 kg/m^2, and class 3 for BMI > 40 kg/m^2 [1]. The following classification system also exists for individuals with class 3 obesity: morbid obesity applies to BMI 40–49.9 kg/m^2; super obesity to BMI 50–50.9 kg/m^2; and super-super obesity for BMI ≥ 60 kg/m^2. There is currently no alternate obesity classification for parturients, although some groups have suggested using cut-off values 5 kg/m^2 higher during pregnancy[2].

In parturients with morbid obesity, the frequency of a cesarean section is more than double that in normal parturients, and the risk of gestational hypertension, preeclampsia, gestational diabetes, macrosomia, and wound complications is also increased. In addition, there is a high incidence of endotracheal intubation failure during general anesthesia, a high risk of death from sequelae of the lung or heart, and a high incidence of failure

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and sequelae in regional anesthesia[1,3]. Neuraxial anesthesia can be challenging to place in the obese parturient, but is the preferred anesthetic for cesarean delivery to avoid airway manipulation, minimize aspiration risk, prevent fetal exposure to volatile anesthetic, and decrease risk of post-partum hemorrhage from volatile anesthetic exposure[2].

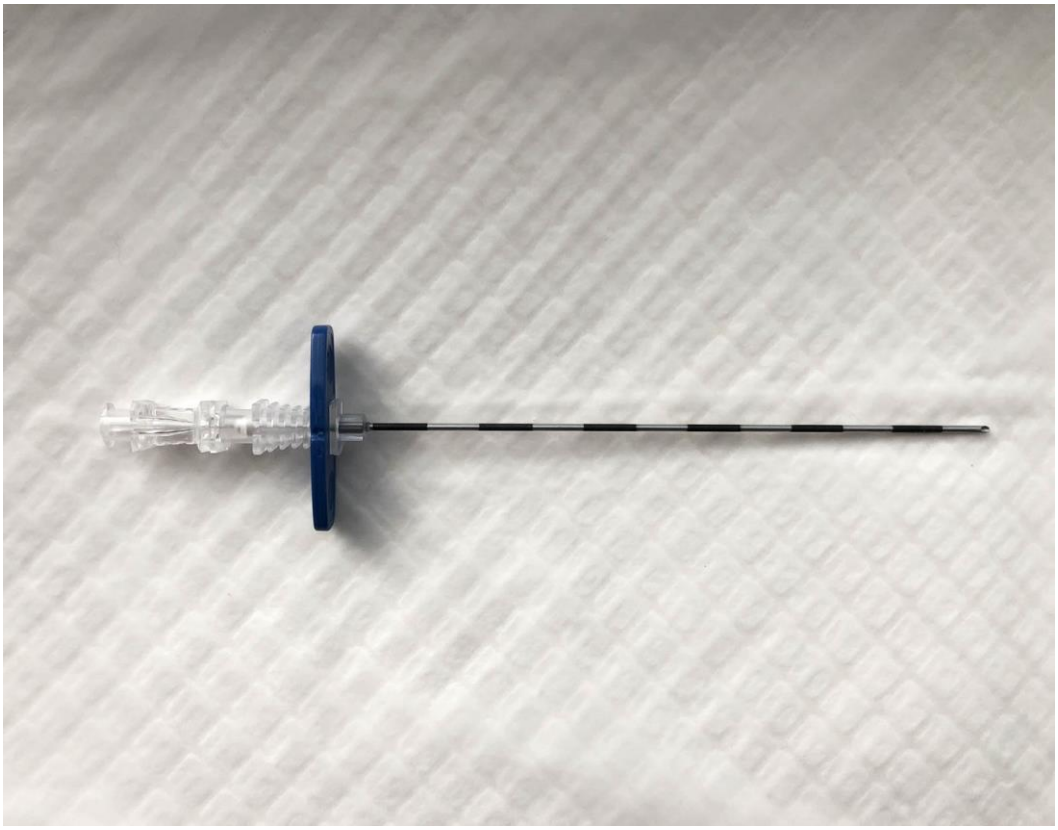
We report a case of combined spinal epidural anesthesia performed for cesarean section of a 37-week pregnant woman with BMI 47.3 kg/m^2 and review of the literature. Written consent was taken from our patient for publication of this case report.

CASE REPORT

A 28-year-old primigravida, with BMI 47.3 kg/m^2 (height 178 cm, weight 150 kg) at a gestational age of 37^{+3} weeks, was suggested for emergency caesarean section (CS) category 2 with indication of active labor and fetal distress. Two years previously, the patient was diagnosed with hypertension, which was controlled with nifedipine 20mg twice daily. On arrival in the operating room intravenous access was established with two peripheral intravenous lines 18G and basic monitoring was attached. Her vital signs on admission were blood pressure 155/80 mmHg, heart rate 105 beats/min, respiratory rate 20 breaths/min and pulse oxygen saturation level 97%. Preoperative investigations and electrocardiography (sinus rhythm) were within normal limits with hemoglobin 12,3 g/dl, white blood cells count 13400, platelet count 366x10^3/μL, INR 0.86, aPTT 35.3 sec. Fasting status was 6 hours.

We explained the risks and possible complications of general anesthesia and the parturient gave her informed consent for regional anesthesia. The parturient was placed in the sitting position for easier confirmation of the landmarks. We successfully identified the iliac crests and the spinous processes of the thoracic vertebrae, but the entire lumbar section of the vertebral column was not palpable enough due to the deposit of subcutaneous fat and the presence of oedema. Considering the possibility that the epidural space can be deeper than 8 cm, we chose to use a long 120mm 18-gauge Tuohy needle (EpiStar Tuohy 18G/1,35 x 120mm) for the identification of the epidural space. After sterile preparation, the skin was locally anesthetized with 40mg of 1% lidocaine and the epidural space was identified successfully with the loss of resistance to air (LORA) technique via the L2-L3 intervertebral space, 100mm in depth from the skin. We did not try to perform Combined Spinal Epidural through the 120mm Tuohy needle because in our hospital the longest spinal needle is 135mm length (Vygon Whitacre spinal needle 27G - L. 135mm), that is not enough to surpass the Tuohy (Image 1). An epidural catheter was successfully placed and secured without eliciting paresthesia, without intravenous placement or return of CSF. A test dose with 40mg of 2% lidocaine was administered.

Image 1. Long spinal needle (135mm) through a long Tuohy needle (120mm). Spinal needle's length is not enough to surpass the long Tuohy needle.



Immediately after the secure placement of the catheter, we placed an 80mm 18G Tuohy needle (in the L3-L4 intervertebral space in 70mm depth from skin (Image 2), aiming to use it as a guide for the 135mm 27-gauge Whitacre pencil point spinal needle.

After dura puncture, CSF was confirmed, and 11mg of 0.5% hyperbaric bupivacaine and 10mcg of fentanyl were injected into the subarachnoid space. Both needles were retracted simultaneously, and the patient was then placed in a supine position with left lateral pelvic tilt to avoid aorto-caval compression. Simultaneously, an infusion of a dilute norepinephrine solution (8 mcg/ml) in a standard rate of 15 ml/h and a rapid 1,000 mL crystalloid (Lactated Ringer's solution) cohydration were intravenously administered. Sympathetic block at T6 level was confirmed after 6 minutes without the occurrence of hypotension (BP: 128/65 mmHg and heart rate as 80 beats/min). The combined spinal-epidural was performed without complications and a male neonate was delivered (3,280gr) with Apgar scores of 8 and 9 at the first and fifth minute, respectively. After birth, an Oxytocin infusion (20 IU/1000 ml Lactated Ringer's) was started as an uterotonic to minimize blood loss. The surgery was completed uneventfully in 90 minutes and the parturient did not experience intraoperative pain. She was transferred to the post

anesthesia care unit (PACU) for monitoring. After 80 minutes, full mobilization of legs and normal vital signs the mother was transferred to surgical high dependency unit (HDU).

Image 2. Preforming spinal anesthesia using a long spinal needle (135mm) and an 80mm Tuohy as an introducer.

DISCUSSION

The alarming worldwide increases in obesity, particularly extreme or "morbid obesity" (defined as a body mass index [BMI] of more than 40 kg/m^2), means that all healthcare providers must be familiar with the important anatomic and physiologic changes that accompany such patients. This applies even more for anesthesiologists since the obese patient can present many challenges during their perioperative management. More than half of pregnant women are overweight or obese, hence constituting a risk factor for multiple comorbidities. The odds of a difficult tracheal intubation, which was defined as requiring more than one attempt with direct laryngoscopy (DL), were greater in obese patients compared to lean patients. Before initiation of anesthesia in the morbidly obese patient, the upper body and

head should be put in ramp position ("head elevated laryngoscopy position") and the operating table in reverse Trendelenburg position [4,5] in order to avoid further obstruction of the upper airway and to compensate the FRC and the compliance reduction of the lungs and chest wall. Pre-oxygenation by face mask in these morbidly obese patients should be initiated with deep vital capacity breaths rather than normal tidal volume inspiration. Furthermore, installation of apnoeic oxygenation could be considered to extend safe apnea period[4]. It is important to emphasize that apnoeic oxygenation by any route cannot substitute ineffective pre-oxygenation, and that the patient's upper airway must remain patent for delivery of O_2 to the lungs. A non-patent airway results in alveolar collapse and rapid desaturation. Therefore, for successful apnoeic oxygenation, head elevation, jaw thrust, nasal prongs, or an oral airway may be required.

Both obesity and pregnancy have been implicated as risk factors when referring to operative and post-operative complications and comorbidities such as diabetes, pre-eclampsia and venous thromboembolism during pregnancy[6]. Evenmore, they appear to pose increased difficulty in anesthetic management, particularly in securing the airway. This difficulty in mask ventilation may be more prominent in obese patients due to upper airway obstruction and the excess of adipose tissue on the breast, neck, mouth and pharynx[5]. BMI > 40 kg/m^2 is associated with a 13% increased risk of difficult intubation, and the failure rate of endotracheal intubation for parturient is reported to be 8 times higher than the general population[1]. However, a recent study suggests that although obesity is associated with increased risk of difficult intubation, the degree of obesity does not convey more risk[7].

Alignment of the various axes of the pharynx and larynx is a requisite of direct laryngoscopy and view of the laryngeal inlet. Failure to align these axes results in unsuccessful patient intubation[8]. The incidence of difficult airway among obese patients is higher than the general population. Video laryngoscopy facilitates viewing and may decrease the risk of failed airway management in the obese parturient[9]. While the risk for difficult intubation is increased in the obese patients compared with the general surgical population, pregnancy itself is associated with a further increase in risk due to airway changes during labor[10].

The combined stratification of the risk confronting a difficult airway makes regional anesthesia the safest alternative for a caesarean section. Successful neuraxial analgesia is mandatory in obese parturients as they are at greater risk for both instrumental and Cesarean delivery (CD). Failed regional techniques may lead to general anesthesia which potentially includes difficult airway, aspiration pneumonitis and failed resuscitation from hemodynamic collapse.

In a single centre retrospective study including 2485 parturients, receiving labor epidural analgesia they recorded the "failure" and the "difficulty" of epidural placement. "Failure" was defined as either inadequate analgesia or a positive test dose, requiring replacement, and/or when the anesthesia record stated they failed. "Difficulty" was defined as six or more needle redirections or a note indicating difficulty in the anesthesia record. Authors concluded that patients with a BMI of 30 kg/m^2 or higher had a higher chance of both failure and difficulty with two and almost three-fold increases, respectively. Regression analysis indicated that failure was best predicted by BMI and less provider training while difficulty was best predicted by BMI[11].

The most common method for cesarean section is single-shot spinal anesthesia as it is rapid and offers an intense neuraxial block. Concomitantly the use of a small dose of local anesthetic into the subarachnoid space avoids fetal exposure to the drug and lowers the incidence of systemic toxicity from the local anesthetic. However, disadvantages as hypotension and limited control of the sensory level remain present[1].

Sixty-eight per cent of obese non pregnant patients present difficulty in palpating landmarks versus 5% of patients with a normal BMI[12]. Additionally, in obese patients, it is easier to identify landmarks in the sitting position[10] than in the lateral position. Furthermore, spinal anesthesia in these patients is expected to require a spinal needle longer than the standard spinal needle. In a prospective, observational study with neuraxial procedures in 427 pregnant patients the major finding was that the best predictors of neuraxial technique difficulty were back flexion and ease of palpation of vertebral landmarks. Obesity did not directly predict difficulty of the neuraxial technique but did predict both difficult palpation and reduced flexion[13]. However, epidural anesthesia and CSE should be considered as alternatives.

CSE combines the desirable features of a single-shot spinal technique with the ability to extend the block duration through the epidural catheter. The identification of the epidural space with the larger Tuohy needle is technically easier in an obese patient as it provides greater tactile feedback to the practitioner. The Tuohy needle then acts as an introducer for the spinal needle and facilitates identification of the intrathecal space, using a needle-through-needle technique. A randomized control trial in obese women undergoing cesarean delivery showed that the use of a CSE technique resulted to easier identification of the intrathecal space when compared to the standard single-shot spinal technique[14]. CSE also allows the administration of a lower intrathecal dose and titration of the block using the epidural catheter with additional local anesthetic or with the epidural volume expansion technique, accomplished using epidural saline[15]. In a study of 44 obese parturients who required cesarean delivery,

participants were randomized to either CSE or single-shot spinal anesthesia. The mean time to perform CSE was no different than the mean time to perform single-shot spinal anesthesia. This study did not only examine the mean times but also included the number of times the provider was able to complete the procedure in under 10 minutes (71% for spinal anesthesia and 100% for CSE anesthesia)[14]. However, further specific evaluation of the technique and its effects in morbidly obese parturients must be evidenced[2].

Introducing a spinal catheter into the subarachnoid space, described as a continuous spinal anesthesia technique, is another option with several advantages such as gradual titration of a dense block to a desired cephalic level. However, monitoring hemodynamics and respiratory status is crucial for minimizing the risk of a total spinal[16]. The use of this technique has been advocated by some for emergency cesarean delivery in the obese parturient, as it may be a more efficient way to locate the intrathecal space when compared to a smaller spinal needle or a CSE technique[8]. Routine use of this technique is, however, limited by the increased risk of post dural puncture headache (PDPH).

The surgical approach in the morbidly obese parturient, particularly in patients with a large pannus, may have to be considered. Occasionally surgeons perform a cesarean delivery using a supraumbilical vertical midline incision. This technique can increase the risk of postoperative respiratory compromise as a result of pain and diaphragmatic splinting. A double catheter technique, providing intraoperative anesthesia using a lumbar CSE and postoperative analgesia with a low thoracic epidural catheter, could be an option and has been reported in a parturient with a BMI of 76 kg/m^2 [16]. Intraoperative anesthesia with a lumbar continuous spinal and postoperative analgesia with a low thoracic epidural are provided in another case series of super-morbidly obese parturients for cesarian delivery with a double neuraxial catheter. In addition, it has been shown a lower incidence of PDPH when the spinal catheter is left in situ for 24 hours or more[17].

The development of a headache from an accidental or “intended” dural puncture in obese gravidas is lower due not to the body habitus but rather to the group’s higher cesarean delivery rate. Patients who are obese and who experience accidental dural puncture have decreased PDPH, as highlighted by a study of 99 parturients in which the percentage of patients with PDPH and a BMI<30kg/m^2 was 45%, whereas it was 25% if the BMI was>30 kg/m^2.[9] The postulated mechanism was that the abdominal fat increased the pressure within the epidural space, decreasing the rate of CSF loss. The risk of developing a PDPH after an accidental dural puncture is higher after vaginal birth compared with cesarean section[18]. The latter is due to the bearing down during the second stage, resulting in an increase in dural tearing and subsequent

increase in CSF loss. In a retrospective review on 18315 obstetric epidural and combined spinal-epidural insertions, identifying 125 (0.7%) accidental dural punctures or post-dural puncture found no evidence that women of higher body mass index are less likely to develop a post-dural puncture headache or that the characteristics of the headache and use of epidural blood patch were different[19]. These were further confirmed by a retrospective cohort study including 518 patients showing the association of pushing during vaginal delivery and an increased likelihood of a PDPH, while comparing high and low BMI groups (cut-off value of BMI 31.5 kg/m^2). Although the incidence of a PDPH was lower in subjects with high BMI, the severity and need for treatment of a PDPH were not influenced by body weight[20].

There is a debate in the recent literature about ultrasonography and its use in neuraxial blocks. Pre-procedural ultrasound aids in understanding the anatomy of the lumbar spine and may facilitate blocks in difficult cases such as the elderly, obese patients, and patients with anatomical abnormality of the lumbar spine[21]. Another study showed that an epidural placed with ultrasound-determined landmarks not only improves the success of epidural placement but also minimizes the number of intervertebral levels with decreased pressure pain threshold (PPT)[22]. Perna et al.[23] in a prospective randomized trial reported that pre-puncture ultrasound assessment shows the exact location of the intervertebral space, the optimal point of insertion and the tilt angle of the needle, the depth of the epidural space and any anatomical abnormalities of the spine, thereby increasing the success rate and reducing procedural complications of the blind approach and the LOR technique.

On the other hand, there are reports showing that the use of pre-procedural spinal ultrasound by a cohort of anesthesia trainees did not improve the ease of insertion of labour epidural catheters in patients with easily palpable lumbar spines, as compared with the traditional palpation technique based on anatomical landmarks[24]. In another randomized controlled trial, including 108 parturients the rate of successful epidural catheterisation at the first needle pass was 60% in the palpation group compared to 58.5% in the ultrasound group, concluding that it remains unclear whether pre-procedural ultrasound improves the epidural catheterisation in parturients with palpable anatomical landmarks undergoing cesarean delivery[25].

Recently, a large meta-analysis was published confronting conventional landmark palpation vs. pre-procedural ultrasound for neuraxial anesthesia. The co-primary outcomes were the first-pass success rate and the total time taken for the identification of the needle insertion point and the performance of the neuraxial procedure. The first co-primary outcome, the first-pass success rate, was reported in 1253 patients by 13 trials. It was increased by a risk ratio (95%CI) of 1.46 with ultrasound compared with

landmark methods. The second co-primary outcome, the time taken for the identification of the needle insertion point and the performance of the neuraxial procedure, was reported in 709 patients by 8 trials. No difference was demonstrated between ultrasound and landmark methods ($p < 0.00001$, $I2 = 93\%$). Once again it reported that for patients with an easy predictable neuraxial procedure, pre-procedural ultrasound offered limited benefits. However, in those for whom the neuraxial procedure was predicted to be difficult, the increase in first pass success rate with pre-procedural ultrasound was not associated with an increase in the total time taken to perform the procedure. The authors concluded that the use of pre-procedural ultrasound increased the first-pass success rate and decreased the incidence of complications without an increase in overall procedural time when compared with the traditional method of landmark palpation. Another benefit includes improvement of the operator's technical ability to site the neuraxial block, decrease the incidence of failure of analgesia or anesthesia and reduce the intraoperative pain score[26].

Multiple cases of broken spinal needles in obstetric patients have been reported in the literature over the last decade. Morbid obesity, increased resistance during placement and redirection of the spinal needle without appropriate mobilization of the introducer are strongly associated with the complication[27].

American College of Obstetricians and Gynecologists (ACOG) and the Royal College of Obstetricians and Gynecologists (RCOG) in conjunction with the Centre for Maternal and Child Enquiries published guidelines recommending a multidisciplinary team approach when caring for the obese parturients. These include an anesthesia consultation in the third trimester for women with a BMI >40 kg/m2. During this consultation, a comprehensive history and physical examination should be performed, with emphasis on the evaluation of the airway, as well as the cardiovascular and pulmonary systems. A thorough discussion of all the aspects of the anesthesia should take place with the patients, including an explanation of the benefits of neuraxial analgesia and anesthesia and the fact that neuraxial techniques might be technically challenging and time consuming; therefore, parturients should be encouraged to request neuraxial analgesia early in labor[28].

Multimodal analgesic strategies for postoperative analgesia have substituted the solely use of opioids, as to diminish their side effects such as nausea, itching and respiratory depression. The analgesic efficacy of TAP block as a part of multimodal analgesia is established in post-CS cases where intrathecal or epidural morphine is not employed or if general anesthesia was administered. Multimodal analgesia based on neuroaxial anesthesia with morphine in combination with non-opioids such as non-steroidal anti-inflammatory drugs, intravenous

paracetamol and wound infiltration with local anesthetics and abdominal nerve blocks are useful in post-operative analgesic strategy[29] and facilitate early mobility, early recovery, and early hospital discharge with minimal side effects on the mother and infant[30].

Postpartum women are at an increased risk of venous thromboembolism. Early mobilization together with graduated compression stockings, low molecular weight heparin should be used to prevent thromboembolic disease in patients who undergo cesarean delivery[31].

In summary, anesthetic management of the morbid obese parturient is challenging. The combined stratification of the risk confronting a difficult airway makes regional anesthesia the safest alternative for caesarean section in morbid obese parturients. A Combined Spinal Epidural technique (at the same or different intravertebral space) might be preferred as it is technically easier and offers the option of extending the block if required. The use of small gauge pencil point spinal needles (25-27G) in cesarean sections has the benefit of decrease incidence of PDPH. This encounters technical difficulties and risks in morbid obese parturients because of excessive adipose tissue and the short introducer. In our case we successfully used the Tuohy needle as the introducer in a depth of 7 cm achieving spinal anesthesia.

Antenatal anesthetic consultation is prerequisite and should be performed. These patients are at increased risk of obstructive sleep apnoea and respiratory depression (opioids neuraxial or parenteral), therefore should be monitored continuously for postoperative hypoxemia. Adequate postoperative analgesia and thromboprophylaxis are crucial in the postoperative period.

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