Chapter

Obesity: Unique Challenges at the Time of Cesarean Delivery

Kristina Roloff, Suzanne Cao, Camille Okekpe, Inessa Dombrovsky and Guillermo Valenzuela

Abstract

The obesity epidemic has touched all aspects of obstetric care, including the practice of cesarean delivery. Obesity is an independent risk factor for cesarean delivery, and the increased prevalence of obesity has contributed to the overall rise in primary cesarean delivery seen over the past few decades. Because of the frequent existence of co-morbidities such as hypertension and diabetes, obesity is a plausible contributor to rising maternal mortality. In addition, obese women who undergo both primary and repeat cesarean delivery have a higher chance to develop surgical and post-operative complications, including wound infection and thromboembolic events. Surgical complications increase steadily with increasing maternal weight. In this chapter, we will review the incidence and contributing factors that lead to cesarean delivery in obese patients, peri-operative complications, and strategies to reduce these risks in obese women undergoing cesarean delivery.

Keywords: cesarean delivery, obesity, super-obesity

1. Introduction

Cecelia presents for a routine new obstetric appointment for her second pregnancy. She has had one prior pregnancy, and does not identify any health problems on her intake paperwork. However, she is markedly obese, and her weight is in excess of 500 pounds, more than the average in-office scale can measure. Adequate understanding of risks and management strategies to mitigate her risk is needed to optimize the chances of a health pregnancy outcome.

The prevalence of obesity, defined as body mass index (BMI) ≥ 30 kg/m^2, and super-obesity (BMI ≥ 50 kg/m^2) is on the rise in reproductive aged women. Pregnancy complications such as gestational diabetes, preeclampsia, macrosomia, and stillbirth are more common in obese women than in normal weight patients. Many of these complications occur in a dose dependent fashion; the higher the BMI category, the more likely complications are to occur. The obese patient has both an increased risk for needing an indicated primary cesarean delivery, an increased risk for peri-operative complications, and is at higher risk for failed trial of labor after cesarean delivery. The super-obese patient, in particular, presents a unique challenge to obstetricians planning and preparing for cesarean delivery.

In this chapter, we will review the evidence of surgical risk at the time of cesarean delivery, management options to reduce surgical risks, and practical considerations in performing a cesarean delivery in the obese parturient.

2. Incidence of cesarean delivery in obese women

Estimates of primary cesarean delivery rates in obese patients undergoing trial of labor range from 23 to 49%, and increase with increasing maternal BMI (23–46% BMI ≥30 kg/m^2, 30–47% BMI ≥ 40 kg/m^2, 45–49% BMI ≥ 50 kg/m^2) [1–5]. The most common indications for cesarean delivery are labor arrest (61%) and non-reassuring fetal status (28%) [1]. Pre-labor primary cesarean delivery also increases with increasing BMI class [5].

3. Factors contributing to cesarean delivery in obese women

The reason for the increased incidence of cesarean delivery in obese women is likely multifactorial, and includes higher chances of macrosomia – and hence labor dystocia, disordered and dysfunctional labor patterns, and provider level responses or bias towards cesarean delivery [5].

The combination of obesity and macrosomia significantly increases the chance of cesarean delivery [6]. Both pre-pregnancy BMI category and gestational weight gain are independent contributors to the development of a large for gestational age or macrosomic infant [7–8]. Obese women tend to have higher gestational weight gain, despite stricter weight gain recommendations, and hence larger birth weight babies [7]. A large fetus, for obvious reasons, predisposes the mother to a protracted labor course and cephalopelvic disproportion leading to an indicated cesarean delivery. In addition, fear of shoulder dystocia and neonatal brachial plexus injury, which occurs more often at delivery of obese women even with lower fetal birth weight, may influence the decision to proceed with cesarean delivery [9]. Because of the chances of fetal macrosomia with advancing gestational age, a strategy of elective induction at term may help to reduce the chances of macrosomia, and hence cesarean delivery. Elective induction was not associated with an increased risk of cesarean delivery in women with BMI ≥ 40 kg/m^2 [10].

Obese women also have dysfunctional labor patterns [11]. Obese women are less likely to have spontaneous onset of labor, less likely to achieve vaginal birth following spontaneous labor, and have a higher chance of being exposed to oxytocin than non-obese women [12]. Obese women may require larger doses of oxytocin than their normal weight counterparts, especially when undergoing induction of labor [13]. The pathophysiology of the increased oxytocin requirements and protracted labor course is poorly understood, but may be due to decreased myometrial receptor expression, prostaglandin insensitivity, and impaired myocyte contractility [14]. The dysfunctional and apparently disrupted myometrial activity may contribute to why we see more unplanned cesarean delivery in obese women.

Provider factors also may contribute to the increase chance of cesarean delivery in obese women [15]. Because the decision-to-incision and decision-to-delivery time interval for emergency cesarean delivery is significantly higher in obese women, a recommendation of cesarean delivery may be made earlier, in order to allow adequate time for surgical preparation [16, 17]. The timing of intervention for non-reassuring fetal heart rate patterns likely contributes to increased unplanned cesarean delivery, as well as pre-labor cesarean deliveries [5, 18]. Obese women with prior cesarean delivery are more likely to decline trial of labor after cesarean, which may be due to individual counseling by obstetric providers [19].

Despite the fact that cesarean delivery is performed more often in obese women, it is still a riskier mode of delivery. Planned cesarean delivery, even in super-obese women (BMI ≥ 50 kg/m^2) does not reduce maternal or neonatal morbidity [1].

4. Surgical complications

Important peri-operative complications of cesarean delivery in obese women include wound complications (infection, wound separation), thromboembolic events, and adverse neonatal complications. A history of three or more prior cesarean deliveries further increases the chance of complications such as transfusion, low 1 min Apgar score, and wound complications [20]. The timing of repeat cesarean – unscheduled or planned – may also increase surgical and neonatal risks, especially since obese women are more likely to develop pregnancy complications prompting unscheduled repeat cesarean delivery [21]. Other surgical risks, such as bowel, bladder, or ureteral injury, or broad ligament hematoma, appear to be comparably infrequent in obese and super obese women like in normal and overweight women [22]. Super obesity also increases the chance of maternal ICU admission and length of hospitalization, which is largely driven by maternal co-morbid conditions [23, 24].

4.1 Wound complications

Wound complications – separation and infection, occur in approximately 10% of obese women delivered by cesarean [20, 25–27]. The odds ratio for wound complication in obese women is 1.14–1.65 times normal weight controls, when adjusted for many confounders [25]. There is a marked dose response for wound complications by increasing BMI category, with an odds ratio increase of up to 2.0 for every five-unit increment increase in BMI [28]. Chances of wound infection in super-obese women have been reported as high as 30% [29]. In probably the largest sample reported (38,229 women), wound complications occurred in 14% of women with BMI $\geq$ 45 kg/m^2 following cesarean delivery [25]. Wound separations in particular are seen more frequently in patients with super obesity [30].

An increase in operative time in women who are obese is also dose dependent on BMI category [17, 27, 31]. Longer operative time is strongly correlated to post-operative infection, and may be a potential modifiable factor to reduce wound complication [32]. Other peri-operative and surgical strategies that may help prevent wound complications, such as pre-operative antibiotics, choice of skin incision, and wound closure type are reviewed in Section 4.4.

4.2 Thromboembolic events

Other than cesarean delivery, obesity is the most common risk factor for a venous thromboembolic event (VTE) in pregnancy [33]. The classic Virchow's triad of hypercoagulability, endothelial injury, and stasis of blood flow leads to the well-established risk of VTE during pregnancy. Obesity itself, regardless of mode of delivery, is a significant risk factor for VTE, with reported risks of 1.7 to 5.3 (odds ratio) above normal weight controls [34–37]. Obese pregnant women have greater risk for pulmonary embolism than deep-vein thrombosis (DVT); the adjusted odds ratio for DVT is 4.4 (95% CI 1.6–11.9) and for pulmonary embolism is 14.9 (95% CI 3.0–74.8) [35]. Like other complications, VTE has a dose–response relationship with increasing BMI category [38].

The exact contribution of the combination of obesity and cesarean delivery to VTEs is difficult to quantify. Immobilization and high BMI have a multiplicative effect on risk for VTE [39]. It is very likely that obesity and cesarean delivery also have multiplicative effects on the chance for VTE. Prevention of VTE during cesarean delivery is discussed in Section 6.5.

4.3 Neonatal outcomes

Neonatal outcomes also appear to be influenced by maternal obesity at cesarean delivery. Neonatal morbidity, including low 5-minute Apgar scores (<7), umbilical cord arterial pH < 7.2, base excess ≤8 mmol/L, and neonatal intensive care unit admissions are seen more often in obese women who undergo cesarean delivery. Hypotension during spinal anesthesia, and prolonged puncture time for regional anesthesia is more pronounced in obese women, and has been shown to cause lower umbilical cord pH in obese women undergoing scheduled cesarean delivery [40, 41]. Women who are super-obese at the time of delivery have a 20% chance of neonatal intensive care unit admission [26]. There is a twofold odds increase of adverse neonatal event (low 5 min Apgar score, cardio-pulmonary resuscitation and ventilator support <24 h, neonatal injury, or transient tachypnea of the newborn, grade 3, 4 intraventricular hemorrhage, necrotizing enterocolitis, seizure, respiratory distress syndrome, hypoxic ischemic encephalopathy, meconium aspiration, ventilator support >2 days, sepsis and/or neonatal death) in women with super obesity compared to their normal weight controls [42]. Despite the tendency towards earlier cesarean delivery, the inherent delays and slower decision-to-incision and incision-to-delivery times involved in moving obese women to the delivery suite, and in getting the baby out when marked fetal distress is evident may contribute to adverse neonatal outcomes in some cases [43]. However, planned cesarean delivery is not protective against these risks, and suggests an underlying poorly understood biologic etiology may be the source of the increase in adverse neonatal outcomes seen in obese women.

5. Preparation for cesarean delivery in the obese patient

Performing a cesarean delivery, primary or repeat, in an obese patient poses certain challenges to the obstetrician and the operative team. These challenges are amplified in the super-obese patient, where maternal weight requires particular preparation for routine surgical issues, such as physical plant or space preparation, and informed consent.

5.1 Physical plant preparation

Hospital equipment is often not designed for super-obese women. Operating tables, delivery beds, and even scales may have an upper limit weight rating that is lower than the weight of a super obese woman [44]. It is reasonable for a labor and delivery hospital unit to prepare a sufficient number of rooms with the equipment needed to safely labor and deliver a super-obese women, based on the characteristics of the population they serve and the number of deliveries performed. Our institution maintains one room capable of laboring a patient in excess of 500 pounds. The bed has a higher weight rating and is wider, and has hydraulics to assist in mobility should a move to the operating room be indicated. The room also has a lift on the ceiling above the labor bed, which has been instrumental for aiding the super-obese woman in positioning – for example to lift a leg during placement of a Foley catheter. The room is stocked with equipment and supplies necessary to care for an obese patient.

Since obese women carry a higher risk for cesarean delivery and up to a 50% chance of emergency cesarean delivery, preparation of an operating room even when trial of labor is attempted is necessary [44, 45]. If a wide operating room bed is not available, two standard 50-cm width tables can be secured together [44, 46].

Transferring the patient from a labor and delivery bed to an operating table and then back to a medical bed or gurney can be difficult and lead to staff injury. Air-assisted mattresses can be placed underneath obese patients to facilitate bed transfers (e.g., Hovermatt®, HoverTech International, Bethlehem, PA, USA). Some of these mattresses can also provide lateral turns to help position patients to prevent aortocaval compression [47].

Practical considerations for preparation of the operating room for scheduled or emergency cesarean of an obese patient should be part of labor and delivery policy. Supplies, such as extra-large blood pressure cuffs, clothing, and large pneumatic compression devices should be available. Consideration of adequate surgical supplies including long instrument trays and accessible self-retaining retractors (see Section 6.3), as well as pre-operative preparation for anesthetic administration (see Section 6.1) may improve patient safety [48]. A checklist for physical plant preparation for cesarean delivery in the obese patient is presented in **Table 1**.

Nursing care requires particular attention to support the delivery of an obese patient. Nurses require knowledge of how to use specialized equipment, how to

Labor and delivery room
Bariatric bed with frame and trapeze (motorized to improve mobility)
Bariatric chair
Hydraulic lift
Air assisted mattress
Continuous positive air pressure (CPAP) equipment
Large or extra-large blood pressure cuffs
Extra-large clothing (gowns, panties)
Extra-large pneumatic compression devices
Extra-large wheelchairs (motorized to improve mobility)
Toilet to exceed 500 lb. capacity
Operating room
Bariatric operating table, or two standard 50-cm width tables strapped together securely
Air assisted mattress
Large or extra-large blood pressure cuffs
Extra-large pneumatic compression devices
Long instrument tray
Large OR strap
Long spinal needles
Difficult airway cart
Emergency cricothyroidotomy kit
Glide scope
Laryngeal mask airway
Video guided laryngoscopes
Adhesive straps / Elastoplast tape for pannus management
Self-retaining retractors (Alexis-O cesarean, Doyen)

Table 1.
Physical plant preparation checklist for labor and cesarean delivery in obese patients.

adapt ergonomics to prevent staff and patient injury, and preparation for known risks in order to safely care for obese patients undergoing planned or unplanned cesarean delivery [44, 48]. It may even be reasonable to increase nurse to patient ratios in some situations [48].

5.2 Informed consent

Informed consent for cesarean is best initiated well before the operative day, because of the known increase chance of cesarean in obese women, as well as the particular risks described in section 4. Informed consent obtained during labor is known to be particularly brief, and it is unlikely that obstetricians are able to adequately counsel obese patients about their specific risks at time of cesarean delivery [49]. Lack of informed consent can reinforce a claim of medical malpractice [50]. Discussion that includes culturally sensitive and tailored review of the patients' beliefs about her weight may help improve the environment and her delivery experience, and perhaps even impact her health outcomes [51]. It may be reasonable to address and document informed consent during her routine obstetric care visits, and/or at time of admission to the hospital, well in advance of the actual surgery.

6. Surgical considerations

Challenges facing the obstetric team do not stop at preparation. The performance of a safe cesarean delivery in an obese patient starts with adequate anesthesia, continues with adaptations of surgical technique, and concludes with optimization of post-operative care.

6.1 Anesthetic considerations

General anesthesia, epidural anesthesia, and combined spinal-epidural anesthesia are all options for pain control during cesarean delivery in the obese patient. The choice of anesthetic largely depends on the indication for cesarean and the condition of the fetus at time of delivery.

Regional anesthesia puncture times for epidural and combined spinal-epidural may be prolonged in the obese patient, and may even contribute to delays in decision to delivery times seen in obese women [31, 52]. There is a higher chance of regional anesthesia failures needing conversion to general anesthesia, and a higher chance of high block during spinal anesthesia necessitating general anesthesia in super obese women (BMI $\geq$ 50 kg/m$^{2)}$) [31, 53]. Still, dose reductions for spinal anesthesia have not been proven beneficial in obese patients [54]. The obese patient is at risk for a higher number of punctures at time of spinal placement, simply due to spinal cord distance from skin [41, 55]. Ultrasound guided regional anesthesia placement has been shown to reduce number of punctures in obese women [56].

The risk of regional anesthesia has to be balanced against the risks of general anesthesia in obese patients, which include an inherent difficult airway, transplacental passage of paralytic or sedating medication, and longer incision to delivery times. Pregnancy itself increases the chance of difficult intubation, and obesity appears to multiply this risk – noted to be as high as 33% [57]. The obese patient is also at risk for aspiration (especially if a difficult intubation is encountered), as well as earlier oxygen desaturation [58].

Surgical positioning with a maternal 10–15 degree left lateral tilt is very important in obese women, as their pannus may compress the aorta or vena cava leading

to hypotension [44]. Obese women also experience more relative hypotension during spinal anesthesia [40]. In addition, the displacement of the pannus to allow for the surgical incision can increase the chance of respiratory distress [44].

6.2 Selection of the surgical skin incision

There is insufficient evidence to conclude a particular skin incision is superior in the performance of a cesarean delivery in obese women. Various choices have been reported including vertical supra-umbilical, vertical or transverse infraumbilical, and the traditional Pfannenstiel with taping of the pannus if necessary, see **Figure 1**. Vertical incisions are associated with a higher chance of vertical/classical uterine incision, but a lower chance of low 1 and 5 minute Apgar score in women with BMI ≥ 40 kg/m^2 [59, 60]. A randomized feasibility trial of 91 women showed no difference in clinical outcomes between Pfannenstiel and vertical skin incisions, and suggested a larger study would have a low chance of finding a difference [61].

Surgeon preferences lean towards a Pfannenstiel skin incision. A study of surgeon preference of incision type on obese patients between Pfannenstiel with or without taping of the Pannus, and vertical in both emergent and non-emergent cesarean delivery, showed the majority preferred Pfannenstiel with taping of the pannus in both cases [62]. Women prioritize safety when it comes to choice of skin incision. A survey of women with BMI ≥ 40 kg/m^2 showed that neonatal and maternal safety ranked higher in priority over cosmetic outcomes in selection of skin incision [63].

Since a superior skin incision has not been clearly shown, it seems reasonable to choose the skin incision based on clinical characteristics of the maternal habitus, and surgeon preference. If a low vertical, or high transverse skin incision is selected in patients with a pannus, care must be taken to ensure the pannus is not transected.

6.3 Surgical techniques unique to obese women

Barrier self-retaining retractors, such as the Doyen or Alexis-O retractor shown in **Figure 2**, may be used to facilitate exposure and reduce the need for additional hands in surgery to provide retraction. This may be particularly helpful in women with a large pannus. The Hook and Doyen retractor apparatus uses hooks and an

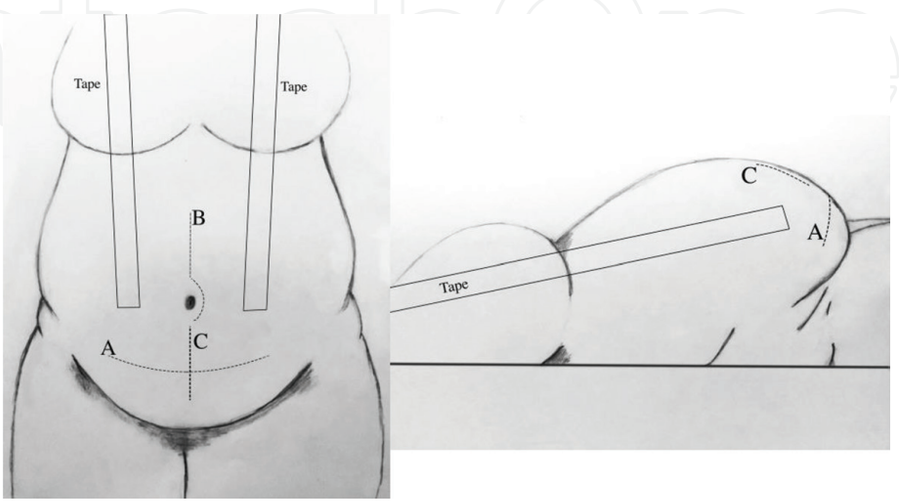

Figure 1.
Surgical skin incision choices. A – Pfannensteil, B – Supraumbilical, and C – Infraumbilical. The Pannus is elevated using tape bilaterally on the upper abdomen with gentle cephalad traction and anchored to the operating table. Care must be taken when choosing a lower abdominal incision (A or B) to avoid transecting the pannus.

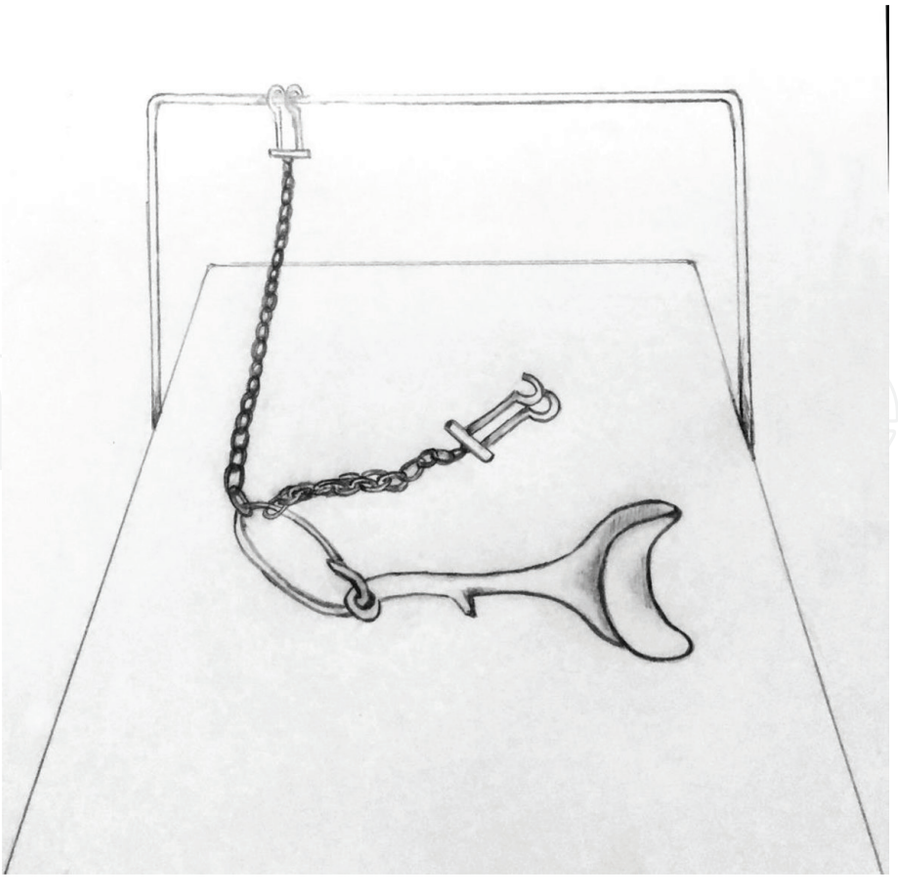

Figure 2.
Hook and doyen apparatus to retract pannus. The doyen retractor is attached with chains and hooks to a lateral bar on the operating table. The doyen retractor is placed under the pannus to elevate it out of the surgeon's way.

adjustable chain to attach a retractor placed under the pannus to a railing across the upper end of the operating table. Care must be used as the pannus is displaced on the maternal abdomen and may lead to hypotension and respiratory difficulties, especially if the patient is under regional anesthesia [64].

Longer operative time leads to increased chance of maternal complications including increased blood loss, transfusion, prolonged hospitalization and wound infection [32]. Unfortunately, the very nature of performing a cesarean section in the obese patient necessitates a longer surgery. Surgical techniques associated with shorter operative time may reduce complications. Techniques that favor blunt instead of sharp dissection reduce operative time, such as a modified Misgav-Ladach technique (limited sharp dissection in favor of blunt expansion), blunt expansion of the uterine incision, and finger-assisted stretching technique, or FAST [65–67]. Standardized operative technique also help reduce operative time [68]. Though not studied in obese women specifically, barbed sutures for uterine closure are also associated with shorter operative times [69].

Evidence suggests that closure of the subcutaneous tissue (if over 2–3 cm in depth) and avoidance of subcutaneous drains decrease the chance of wound complications in obese patients [70–72].

There is one known exception to the principle of reducing operative time to improve maternal outcomes. Subcuticular closure with suture reduces chances of wound complications, despite taking more time [73]. The choice of suture (4–0 vicryl or 4–0 monocryl) did not have an effect on wound complications in a randomized controlled trial with a large number (66%) of obese women [74].

6.4 Prevention of surgical site infections

Pre-operative antibiotic prophylaxis within 60 min and prior to skin incision has been associated with a significant reduction in surgical site infection in all women, regardless of their weight. However, the pharmacology of pre-operative antibiotics is altered in obese women. Higher doses of pre-operative antibiotics may be needed to prevent surgical site infection. Women with BMI ≥ 30 kg/m^2 may need 3 g of pre-operative cefazolin to achieve similar tissue concentrations of antibiotics as normal and overweight women [75–77]. The addition of a 48-h course of cephalexin and metronidazole in addition to the pre-operative cephalosporin IV prophylaxis has also been shown to reduce the chance of post-operative surgical site infection (within 30 days) in obese women [78].

The addition of azithromycin to standard antibiotic prophylaxis in women of all weight groups undergoing non-elective cesarean delivery has been proven to reduce wound infection [79]. Given the high chance of wound infection in obese patients, it may be reasonable to add azithromycin to standard antibiotic prophylaxis, even in women undergoing elective scheduled cesarean delivery [71]. In our institution, the addition of azithromycin has reduced surgical site infections in a longitudinal cohort quality improvement project (unpublished data).

Different types of skin incisions have not been definitively shown to reduce wound complications. Small studies have shown similar chance of wound complications in obese women with Pfannenstiel and vertical incisions, which is surprising given the moist and microbe rich environment that exists in the skin folds of the pannus [80]. A meta-analysis initially suggested vertical skin incisions may reduce chance of wound infection, but this article was subsequently redacted due to a miscalculation that favored Pfannenstiel for reducing risk of infection [81]. Evidence now suggests no clinical difference in outcomes of women with BMI ≥ 40 kg/m^2 who have either Pfannenstiel or vertical skin incisions [61].

Self-retaining retractors, unfortunately, have also not been found to reduce surgical site infection [30, 82].

As mentioned in Section 6.3, subcuticular closure with suture reduces chances of wound complications in obese women [73]. Skin closure with staples is associated with a higher chance of wound complication (infection, separation) in obese women within 6 weeks of delivery [83]. However, this effect did not persist in women with class III obesity (BMI ≥ 40 kg/m^2 [84]. The use of staples may be considered in super-obese women.

Many surgeons place prophylactic JP drains in the subcutaneous tissue of obese patients undergoing cesarean delivery, with the thought wound seromas and infection may be prevented. On a large multicenter randomized trial, obese women with subcutaneous drains had similar rates of wound complications as those with subcutaneous fat closure only [85]. However, more recent studies suggest that the subcutaneous tissue should be closed if more than 2–3 cm deep, and subcutaneous drains should be avoided to prevent surgical site infections [70–72].

Prophylactic administration of negative pressure wound therapy (Wound V.A.C.®, Prevena™) in obese patients with a BMI ≥ 40 kg/m^2 is associated with a reduction in surgical site infections [86]. Super-obese women may benefit from prophylactic application of negative pressure wound dressings, but a systematic review and meta-analysis suggests this strategy is not beneficial when cut offs for application are dropped to women with a BMI ≥ 30 kg/m^2 [87].

Despite implementation of known evidence based measures to prevent surgical site infection (prophylactic antibiotics within 60 min prior to skin incision, chlorhexidine –alcohol for skin antisepsis with 3 min of drying time before incision,

Weight (lb)	Dose (mg)*
200–240	50
241-290	60
291–330	70
331–370	80
371–400	90
>400	100

*Administered every 12 h. Adapted from Overcash et al. [95].

Table 2.
Weight based enoxaparin dosing.

closure of subcutaneous tissue if ≥2 cm depth, and subcuticular skin closure with suture), surgical site infection remains high in obese women [88].

6.5 Prevention of venous thromboembolic events

Pneumatic compression devices, heparin, and low molecular weight heparin (LMWH) have all been suggested as strategies to reduce VTE in obese women undergoing cesarean delivery. Recommendations from major societies on the strategies for prevention of venous thromboembolism in obese women undergoing cesarean delivery are in conflict [89]. The American College of Obstetricians and Gynecologists (ACOG), the American College of Chest Physicians (ACCP), and the Royal College of Obstetricians and Gynecologists (RCOG) all differ slightly in their published recommendations. ACOG suggests all women undergoing cesarean delivery should use post-partum pneumatic compression devices, but gives no additional specific recommendations regarding obesity [90, 91]. The ACCP suggests obesity is a minor risk factor for VTE, and does not recommend post-partum pharmacoprophylaxis unless two minor risk factors are present [92]. In contrast, the RCOG suggests pharmacoprophylaxis should be administered to women with a BMI > 40 kg/m^2 who undergo a cesarean in labor.

Given their higher chance of post-operative VTE, it seems prudent to use at minimum pneumatic compression devices for VTE prophylaxis in obese women undergoing cesarean delivery, and has been found to be cost effective [93]. It seems reasonable to consider VTE pharmacoprophylaxis in women with BMI > 40 kg/m^2, though there is lack of evidence to strongly support this strategy [94]. It is equally important to consider that standard prophylactic doses may not be sufficient to achieve adequate concentrations due to the pharmacokinetics of LMWH in obese persons. Weight-based dosing of enoxaparin (0.5 mg/kg q 12 h) for prevention of thromboembolism is more effective than BMI-stratified dosing (BMI 40–59.9 received 40 mg enoxaparin q 12 h, BMI 60 received 60 mg q 12 h) in achieving adequate anti-Xa concentrations [95–97]. **Table 2** shows a weight-based enoxaparin dosing strategy for obese women.

7. Conclusion

Cesarean delivery occurs more often in obese women, and increases both maternal and neonatal morbidity. Adequate planning and preparation is required to perform a safe cesarean delivery in obese women, particularly in super-obese patients. Optimal, evidence-based practice includes:

- Adequate physical plant preparation with attention to sufficient equipment, policy, and staff training;
- Initiation of informed consent process during prenatal care visits or at time of admission, well in advance of operation;
- Anesthetic consideration and preparation for increased puncture time, number of punctures, high blocks, and difficult/high risk intubation;
- Selection of skin incision and attention to surgical techniques;
- Application of strategies to reduce post-operative wound complications; and
- Consideration of risk for and techniques to reduce risk for venous thromboembolism.

Despite adequate preparation and attention to prophylaxis against known adverse surgical outcomes, the obese patient will have elevated risk above her normal weight counterpart. Prevention of obesity, and adequate weight loss prior to conception is ultimately the best protection against complications at the time of cesarean delivery in the obese patient.

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Conflict of interest

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Author details

Kristina Roloff*, Suzanne Cao, Camille Okekpe, Inessa Dombrovsky and Guillermo Valenzuela
Department of Women's Health Arrowhead Regional Medical Center, Colton, CA, USA

*Address all correspondence to: kristyroloff@gmail.com

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